NM1-63

Permit Application Vol 2

10/12/16

STATE OF NEW MEXICO
DIRECTOR OF OIL CONSERVATION DIVISION

IN THE MATTER OF THE APPLICATION OF OWL LANDFILL SERVICES, LLC FOR A SURFACE WASTE MANAGEMENT FACILITY PERMIT

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

OCTOBER 2016

VOLUME II: FACILITY MANAGEMENT PLANS

Prepared For:

OWL Landfill Services, LLC
8214 Westchester Driver, Suite 850
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Submitted To:

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

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APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

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OWL LANDFILL SERVICES, LLC

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APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
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APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 1: OPERATIONS, INSPECTION AND MAINTENANCE PLAN

1.0 INTRODUCTION

OWL Landfill Services, LLC (OWL) is proposing to permit, construct, and operate a "Surface Waste Management Facility" for oil field waste processing and disposal services. The proposed OWL Facility is subject to regulation under the New Mexico (NM) Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility has been designed in compliance with the requirements of 19.15.36 NMAC, and will be constructed, operated, and closed in compliance with a Surface Waste Management Facility Permit issued by the OCD.

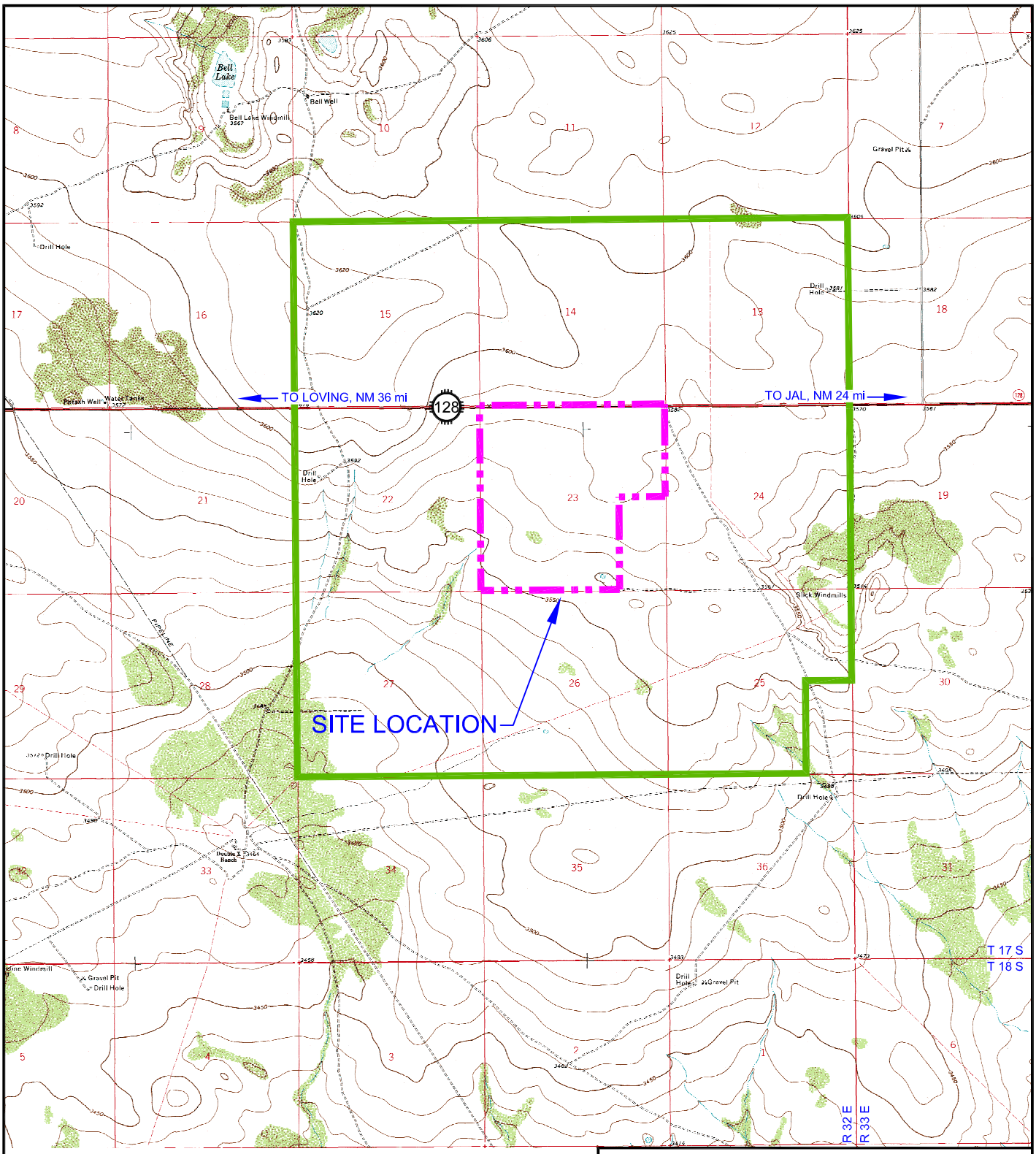
The OWL Facility is one of the first designed to the new more stringent standards that, for instance, mandate double liners and leak detection for land disposal. The new services that OWL will provide fill a necessary void in the market for technologies that exceed current OCD requirements.

1.1 Purpose

The purpose of this Operations, Inspection & Maintenance Plan (the Plan) is provide guidance to the OWL Facility staff in the daily operational procedures that have been established in compliance with 19.15.36.8 and 19.15.36.13 NMAC with the purpose of providing 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 OWL site is located approximately 22 miles northwest of Jal, adjacent to the south of NM 128 in Lea County, NM. The OWL site is comprised of a 560-acre ± tract of land located within a portion of Section 23, Township 24 South, Range 33 East, Lea County, NM (**Figure II.1.1**). Site access will be provided on the south side of NM 128. The coordinates for the approximate center of the OWL site are Latitude 32.203105577 and Longitude -103.543122319 (surface coordinates).



LEGEND

SITE BOUNDARY

1 MILE OFFSET FROM SITE

NOTES:

1) SITE IS LOCATED WITHIN A PORTION OF SECTION 23, TOWNSHIP 24 SOUTH RANGE 23 EAST, LEA COUNTY, NEW MEXICO

2) MAP REFERENCE:
BELL LAKE, NM. 1973 USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP

NORTH

0 2000' 4000'

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\SITE LOCATION.dwg
Date/Time:Sep. 20, 2016-08:22:08 ; LAYOUT: A (P)

SITE LOCATION MAP

OWL LANDFILL SERVICES, LLC
LEA COUNTY, NEW MEXICO

Gordon Environmental, Inc.
Consulting Engineers
213 S. Camino del Pueblo
Bernalillo, New Mexico, USA
Phone: 505-867-6990
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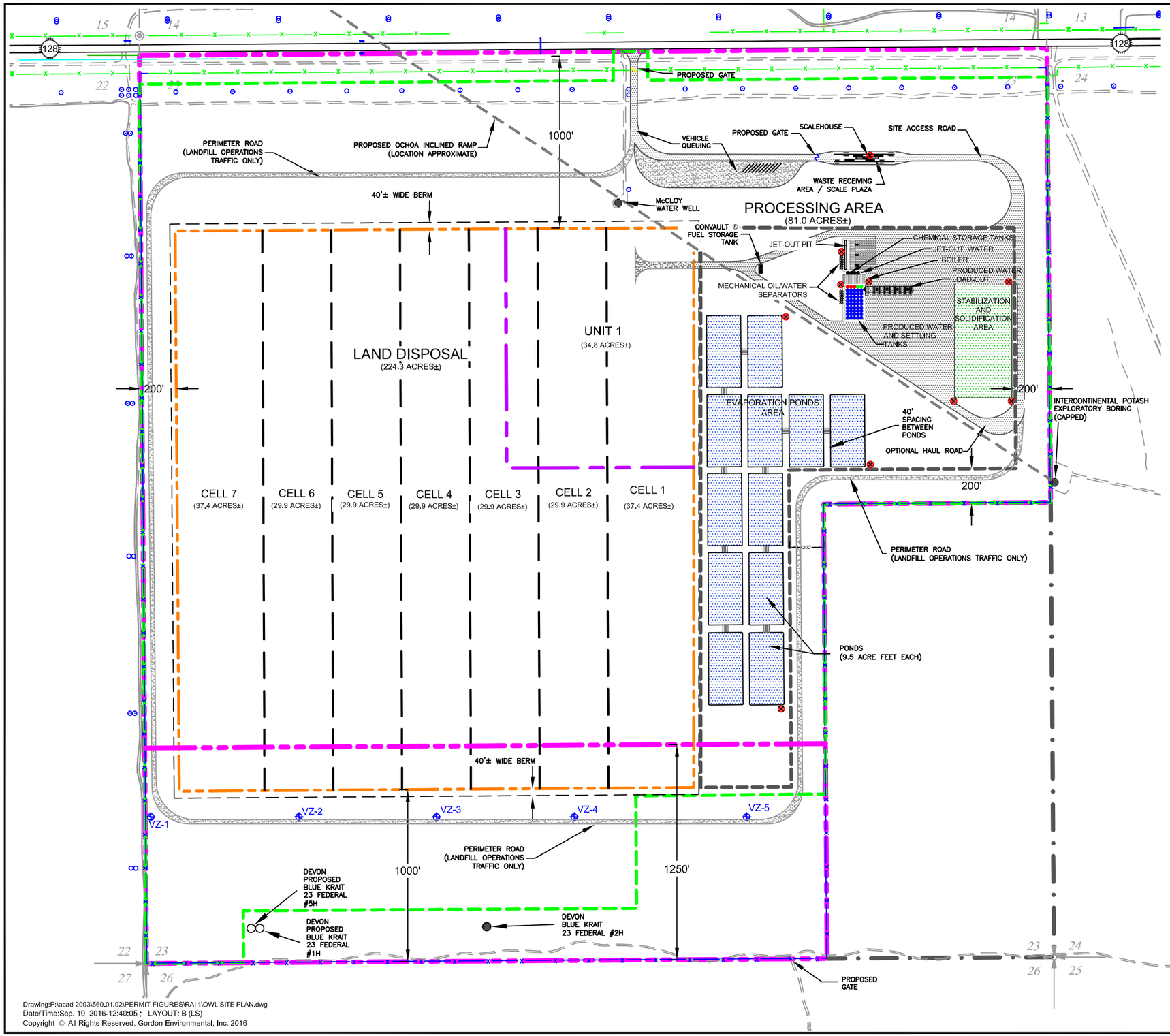
DATE: 09/20/2016	CAD: SITE LOCATION.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.1.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

TABLE II.1.1
OCD Requirements: 19.15.36 NMAC
OWL Landfill Services, LLC

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 OWL Surface Waste Management Facility will comprise approximately 500 acres of the 560-acre site, and will include two main components: an oil field waste Processing Area and an oil field waste Landfill, as well as related infrastructure. Oil field wastes are anticipated to be delivered to the OWL Facility from oil and gas exploration and production operations in southeastern NM and west Texas. The Site Plan provided as **Figure II.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**.



LEGEND

- SITE BOUNDARY (559.5 ACRES±)
- FACILITY BOUNDARY (500.0 ACRES)
- DISPOSAL AREA (224.3 ACRES±)
- PROCESSING AREA (81.0 ACRES±)
- UNIT 1 BOUNDARY (34.8 ACRES±)
- CELL BOUNDARY
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING FENCE
- EXISTING POWER POLE
- EXISTING CULVERT
- PROPOSED 3–STRAND BARBED WIRE FENCE
- PROPOSED UNPAVED ROAD (GRAVEL)
- PROPOSED UNPAVED ROAD (SOIL)
- VZ-2 PROPOSED VADOSE ZONE MONITORING WELL
- PPE AND EMERGENCY EQUIPMENT

NORTH

0 300' 600'

SITE PLAN

OWL LANDFILL SERVICES, LLC
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: 09/16/2016	CAD: SITE PLAN.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.1.2
APPROVED BY: IKG	gei@gordonenvironmental.com	

TABLE II.1.2
Proposed Facilities[1]
OWL Landfill Services, LLC

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 – bays	6

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 innovations, etc.

TABLE II.1.3
OWL Development Sequence[1]
OWL Landfill Services, LLC

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 4,000 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 recovered from the Produced Water Tanks will also be pumped 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 4,000 bbl per day of liquid	The additional oil recovered from the expanded Produced Water Processing Operation process, anticipated to be 6 bbl per day (for a total of 12 bbls 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 OWL site development sequence is subject to change. Different combinations of these improvements may be constructed at any time. OCD will be notified in advance of construction.*

[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

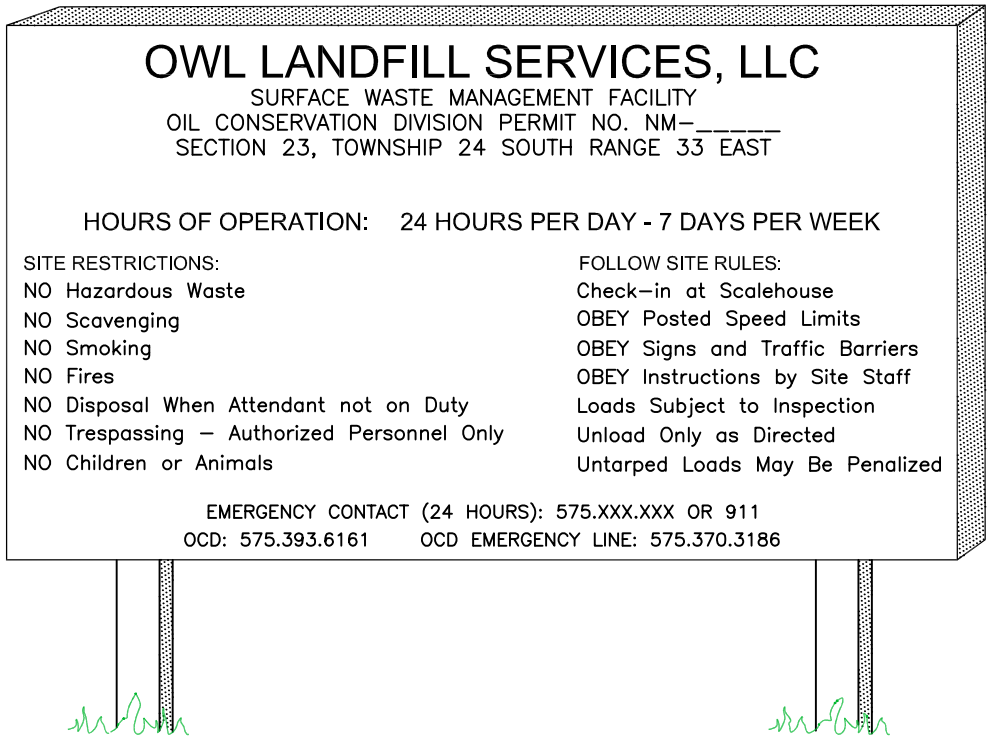
The OWL Facility is located within a 560 acre ± tract in unincorporated southeastern Lea County, approximately 22 miles northwest of Jal, NM (**Figure II.1.1**). The Facility is surrounded by undeveloped space on all sides with NM 128 situated along the northern boundary and mineral exploration (oil and gas) the only local development. The closest permanent residence appears to be located approximately 1.8 miles to the southwest. Lea County does not have zoning specifications on land use in unincorporated areas.

2.2 Access Control

Access control for OWL 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 once constructed.



SITE ENTRANCE SIGN (TYPICAL)

OWL LANDFILL SERVICES, LLC
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: 08/29/2016	CAD: ENTRANCE SIGN.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.1.3A
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\RAI 1\ENTRANCE SIGN.dwg
Date/Time:Sep. 19, 2016-11:38:30

OWL LANDFILL
SERVICES, LLC

LEA COUNTY, NEW MEXICO

SECTION 23,
TOWNSHIP 24 SOUTH
RANGE 33 EAST

OIL CONSERVATION DIVISION PERMIT NO. NM-_____

SITE SIGNS (TYPICAL)

OWL LANDFILL SERVICES, LLC
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: 09/20/2016	CAD: SITE SIGNSdwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.1.3B
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\SITE SIGNS.dwg
Date/Time:Sep. 20, 2016-07:59:29

2.4 Traffic

Traffic will arrive at the OWL Facility by traveling east or west on NM 128, turning south at the site access points into the Processing Area or Landfill. Discussions will be held with NMDOT concerning driveway permit requirements. 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. On-site traffic flow for the OWL Facility is depicted on **Figures II.1.4A** (Processing Area) and **II.1.4B** (Landfill).

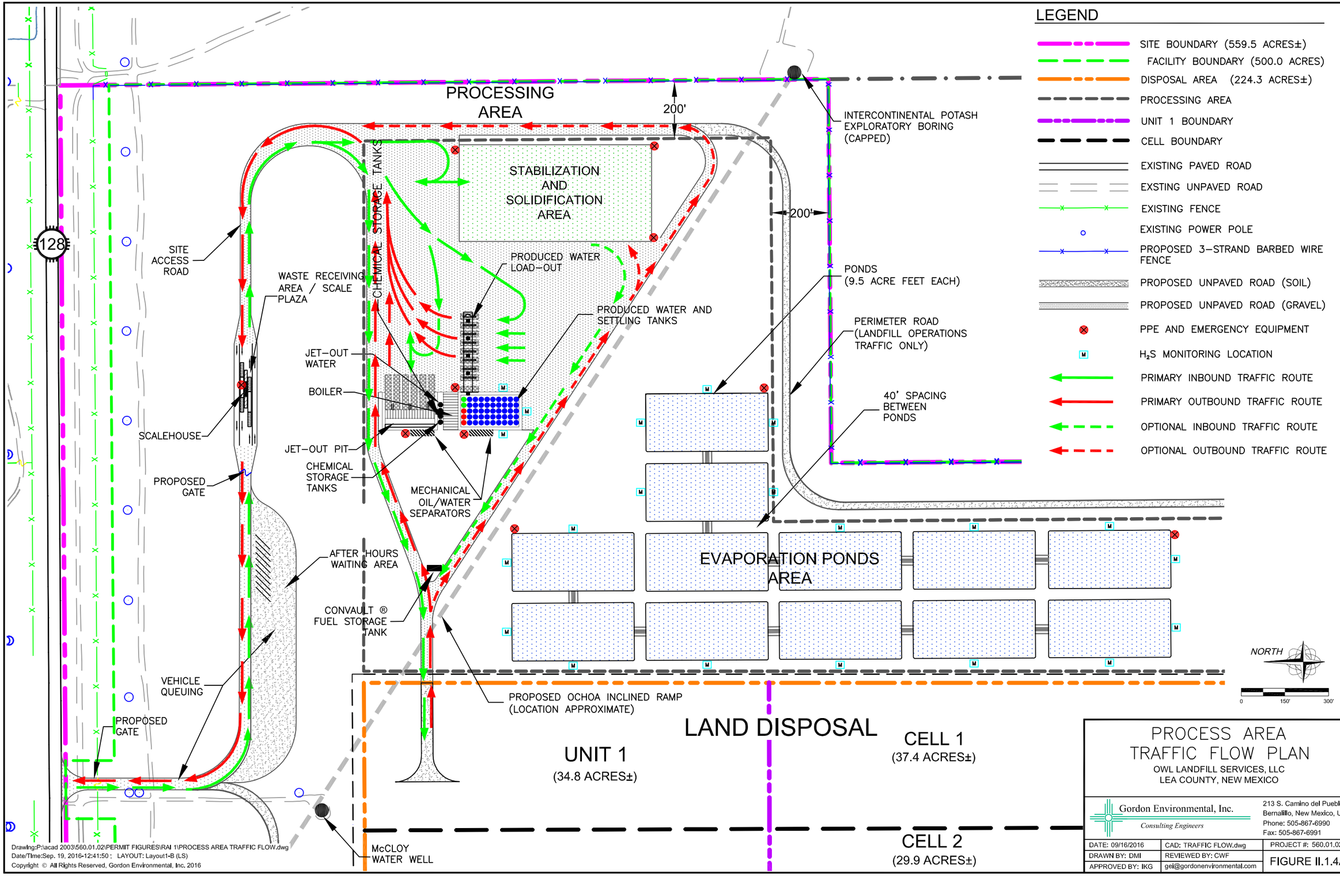
3.0 FACILITY PERSONNEL

3.1 Requirements and Duties

Daily operations at the Facility will be supervised by the OWL management team located onsite in the Scalehouse (**Figure II.1.2**). Management and administrative support will be provided by OWL personnel routinely on-site. Disposal operations will only be conducted when an attendant is on duty. 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
OWL Landfill Services, LLC

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



PROCESS AREA TRAFFIC FLOW PLAN

OWL LANDFILL SERVICES, LLC
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: 09/16/2016	CAD: TRAFFIC FLOW.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: CWF	FIGURE II.1.4A
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\RAI 1\PROCESS AREA TRAFFIC FLOW.dwg
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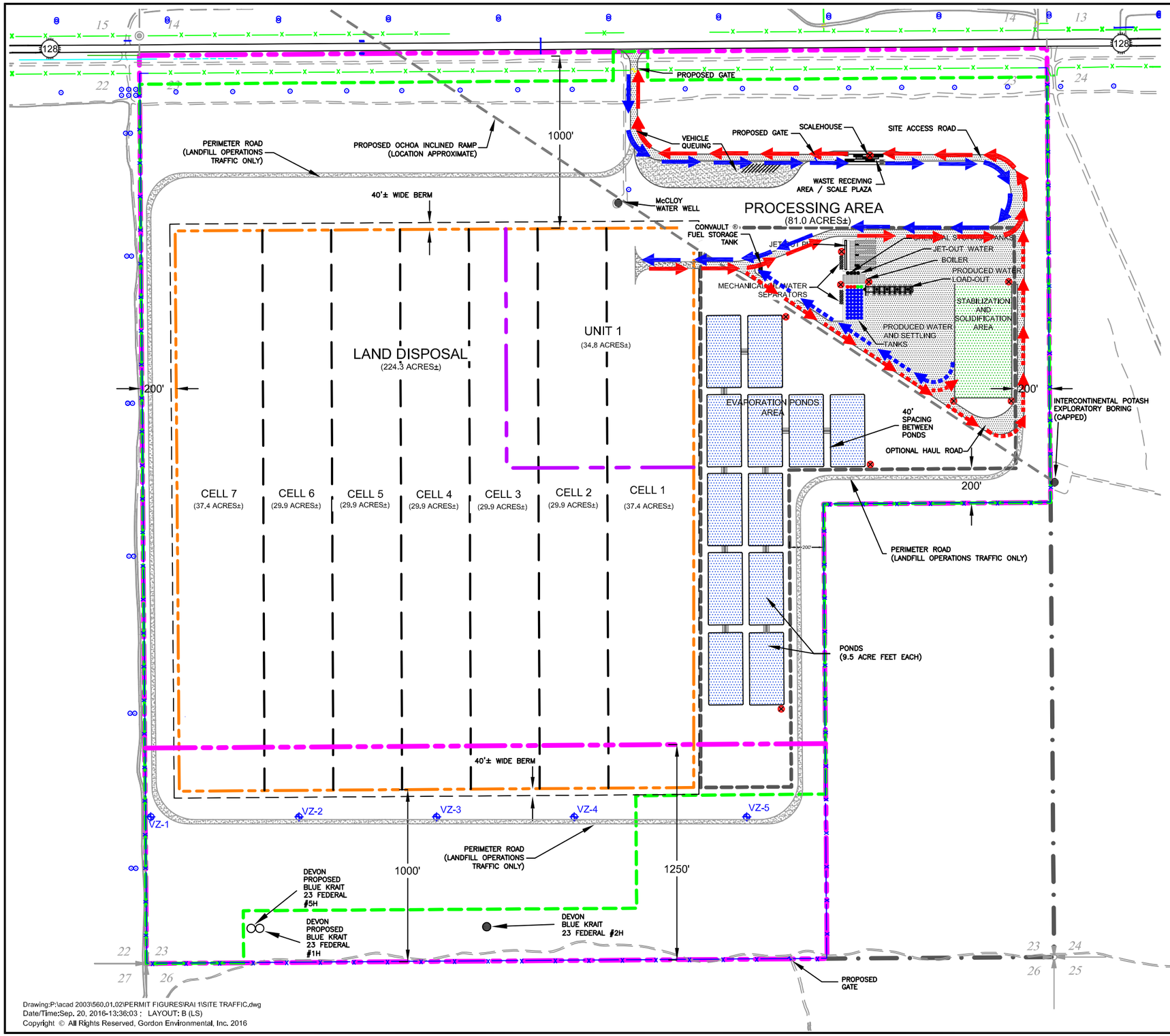

LEGEND

- SITE BOUNDARY (559.5 ACRES±)
- FACILITY BOUNDARY (500.0 ACRES)
- DISPOSAL AREA (224.3 ACRES±)
- PROCESSING AREA (81.0 ACRES±)
- UNIT 1 BOUNDARY (34.8 ACRES±)
- CELL BOUNDARY
- EXISTING PAVED ROAD
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- PROPOSED 3-STRAND BARBED WIRE FENCE
- PROPOSED UNPAVED ROAD (GRAVEL)
- PROPOSED UNPAVED ROAD (SOIL)
- VZ-2 PROPOSED VADOSE ZONE MONITORING WELL
- PPE AND EMERGENCY EQUIPMENT
- PRIMARY INBOUND TRAFFIC
- PRIMARY OUTBOUND TRAFFIC
- OPTIONAL INBOUND TRAFFIC
- OPTINAL OUTBOUND TRAFFIC

NORTH

0 300' 600'

LANDFILL TRAFFIC FLOW

OWL LANDFILL SERVICES, LLC
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: 09/20/2016	CAD: SITE TRAFFIC.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.1.4B
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\RAI 1\SITE TRAFFIC.dwg
Date/Time:Sep. 20, 2016-13:36:03 ; LAYOUT: B (LS)

3.2 Training Requirements

Annual personnel training 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 OWL 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 OWL 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 acceptance 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. The site development sequence involves the initial construction of 20 ft high screening berms to the north (downwind) and east using soils from the “Unit 1” excavation.

4.2 Odor Control

Prior to oil field waste acceptance, vehicles will be 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 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, and downwind screening berms will limit air dispersion of potential odors.

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
OWL Landfill Services, LLC

A water truck will be available to apply water, approved recycled waters, or dust palliatives to the access roads and active areas within the OWL 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 as necessary.
- **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 when wind velocity is high.

- **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 OWL 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 and properly documented non-exempt, non-hazardous oil field wastes. 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 efficiently managing ongoing construction and operations. Equipment units 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 (Typical)
OWL Landfill Services, LLC

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 D6 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

OWL 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 OWL. The Facility will require documentation from the Generators for accepting oil field wastes, including OCD Form C-138 *(Request for Approval to Accept Solid Waste*; **Attachment II.2.A***)*, 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]
OWL Landfill Services, LLC

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. Actual volumes and types will vary dependent upon market conditions.

[2]yd^3 = cubic yards

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

5.3 Sequence of Landfill Development

The OWL 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 seven cells, each of which will contain several waste units. Landfill development will commence with the cells in the northeast corner as shown on **Permit Plans, Sheets 6** (**Volume III.1**). Unit I will be developed first with the construction of upgradient portions of Cells 1 and 2 in the northeast corner of Unit I. Cell development will progress westward through Unit I before continuing in future Units. 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 for odor and dust control. 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 12 months once the final grade is achieved. Non-contaminated soils may be temporarily stored and covered above interim or final grade.

TABLE II.1.8
Landfill Development Sequence
OWL Landfill Services, LLC

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

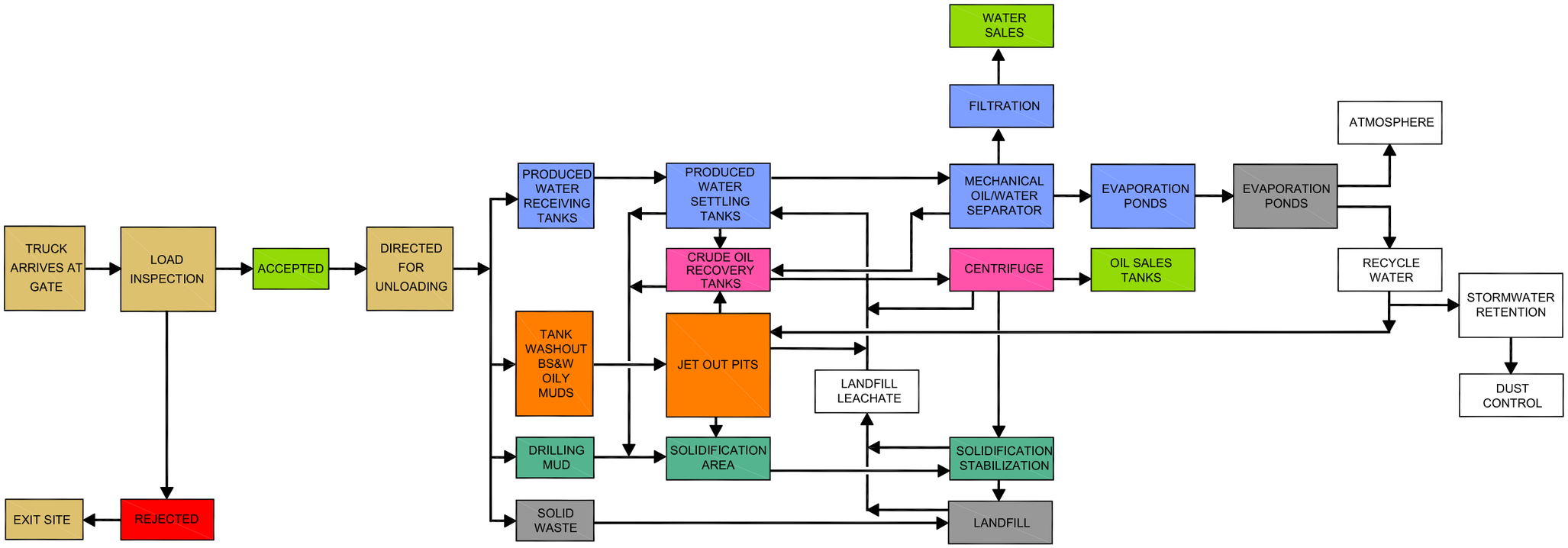
Vehicles delivering waste will approach the OWL Facility entrance from the east or west on NM 128, which is located adjacent to the northern boundary of the site. NM 128 is a paved, two-lane highway with no special weight restrictions, and paved, full-width shoulders. OWL will consult with NMDOT on a suitable intersection design that provides for safe ingress and egress. The site entrance sign will identify prohibited materials and rules of conduct on-site (**Figure II.1.3**). Disposal operations will only be conducted when an attendant is on duty. At the Facility Scalehouse, waste loads will be screened to confirm that the solid waste materials

are acceptable for disposal at OWL. 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** (**Attachment III.1.A**) 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, with minimal compaction.

Waste placement will generally move from the lower (downgradient) portions of the cell to the higher (upgradient) elevations. With the exception of the first "fluff" 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

OWL LANDFILL SERVICES, LLC
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: 08/29/2016	CAD: PROCESS FLOW.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.1.5A
APPROVED BY: IKG	gei@gordonenvironmental.com	

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PROCESS DESCRIPTION:

1. A WASTE VEHICLE ARRIVES AT THE GATE.
2. PAPERWORK IS CHECKED AGAINST SUNDANCE WEST 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 FOUR LOCATIONS:

TANKERS CONTAINING PRODUCED WATER ARE DIRECTED TO ONE OF EIGHT LOAD OUT POINTS AT THE PRODUCED WATER TANKS MANIFOLD.
PRODUCED WATER IS DISCHARGED INTO A 1,000 BBL 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 ADDITIONAL 1,000 BBL PRODUCED WATER 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 TANKS AND TRANSFERRED TO FILTRATION OR 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 TANKS.
SLUDGES AND SEDIMENT SETTLING TO THE BOTTOM OF THE TANK IS TRANSFERRED TO THE SOLIDIFICATION AND STABILIZATION AREA.

THE CRUDE OIL RECOVERY TANKS FEED THE CENTRIFUGE WHICH SEPARATES THE OIL FROM ANY REMAINING WATER. WATER IS RETURNED TO THE PRODUCED WATER TANKS.
SOLIDS RECOVERED FROM THE CRUDE OIL RECOVERY TANKS AND CENTRIFUGE ARE REMOVED TO THE STABILIZATION/SOLIDIFICATION PROCESSING AREA.
OIL RECOVERED FROM THE CRUDE OIL RECOVERY TANKS AND CENTRIFUGE 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 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 TANKS.

PROCESS FLOW DESCRIPTION

OWL LANDFILL SERVICES, LLC
LEA COUNTY, NEW MEXICO

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Consulting Engineers
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Bernalillo, New Mexico, USA
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DATE: 09/20/2016	CAD: PROCESS FLOW DESCRIPTION.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.1.5B
APPROVED BY: IKG	gei@gordonenvironmental.com	

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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.

In order to control litter and mitigate potential odors, the active working face will be covered with 6 inches of soil cover, or an approved alternate cover, as needed. OWL will place an intermediate cover at least 6-inches thick, in addition to daily cover, over areas of the landfill that will not receive further oil field waste for one month or more, but have not reached final elevation. Areas of intermediate cover will be properly sloped to promote clean run-off and minimize leachate generation, and may be used for temporary cover stockpiles. When weather conditions are favorable, intermediate cover may be vegetated with temporary grasses such as rye if the area will not be subject to additional landfilling within 12 months. Alternative stabilization methods for either intermediate or final cover may be deployed as described in **Attachment II.4.A**. If long-term revegetation is required, native grass will be applied following the local Natural Resources Conservation Service (NRCS) recommendations (see Closure/Post-closure Plan, **Volume II.4**). Areas of intermediate cover will be inspected periodically for erosion and settlement, and prompt regrading and maintenance action will be initiated as required. An Intermediate Cover Inspection and Maintenance Plan is provided as **Attachment II.1.G**.

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 OWL Landfill (Cells) gross airspace is approximately 44,770,300 yd^3, with approximately 38,339,200 yd^3 (i.e., 38,339,200 tons) of net airspace (i.e., waste capacity). The longevity of the Landfill, operating 365 days per year, is projected as follows:

- 210 years @ 500 tons per day
- 105 years @ 1,000 tons per day
- 42 years @ 2,500 tons per day

There are many factors that can have an impact on the duration of operations of the OWL 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, OWL may make arrangements for the purchase or temporary 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 OWL 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, OWL 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 facility boundary. H_2S monitors that issue a visual and audible signal at 10 ppm 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 and H_2S as part of routine subsurface monitoring as described in the Vadose Zone Monitoring Plan (**Volume II.9**). 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. The Leachate Management Plan for the OWL Landfill is provided as **Volume II.8**. The Leachate Management Plan details the procedures that will be used to manage contact waters generated at the OWL 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

The OWL Landfill is designed to operate as an all-weather facility under most foreseeable conditions with stormwater management systems installed in advance of need (see Permit Plans, **Volume III.1**). The site's proposed layout, paved and gravel surfaced 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

OWL plans to have continuous waste receiving services available twenty-four hours per day, seven days per week if market conditions warrant. 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. OWL 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.

5.10 Vadose Zone Monitoring

Vadose zone monitoring is described in detail in the Vadose Zone Monitoring Plan provided as **Volume II.9**. 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 vadose well (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 or annual). Additional details are provided in **Volume II.9**.

6.0 LIQUID WASTE PROCESSING

6.1 Operational Rate

Liquid oil field wastes (produced water) will be accepted for processing at the OWL Facility. The average operational rate for the fully developed OWL 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 generator facilities development.

Basic Sediments and Water (BS&W) wastes will be accepted for processing at the OWL Jet-Out Pit. The average operational rate for the fully developed Jet-Out operation is estimated at 1,000 bbl/day of BS&W wastes. The operational rate may increase to over 2,000 bbl/day dependent upon market conditions and the rate of facility development.

Drilling Mud waste will also be accepted for stabilization and solidification. The average operational rate for the fully developed stabilization and solidification area is estimated at 2,000 bbl/day depending on market conditions.

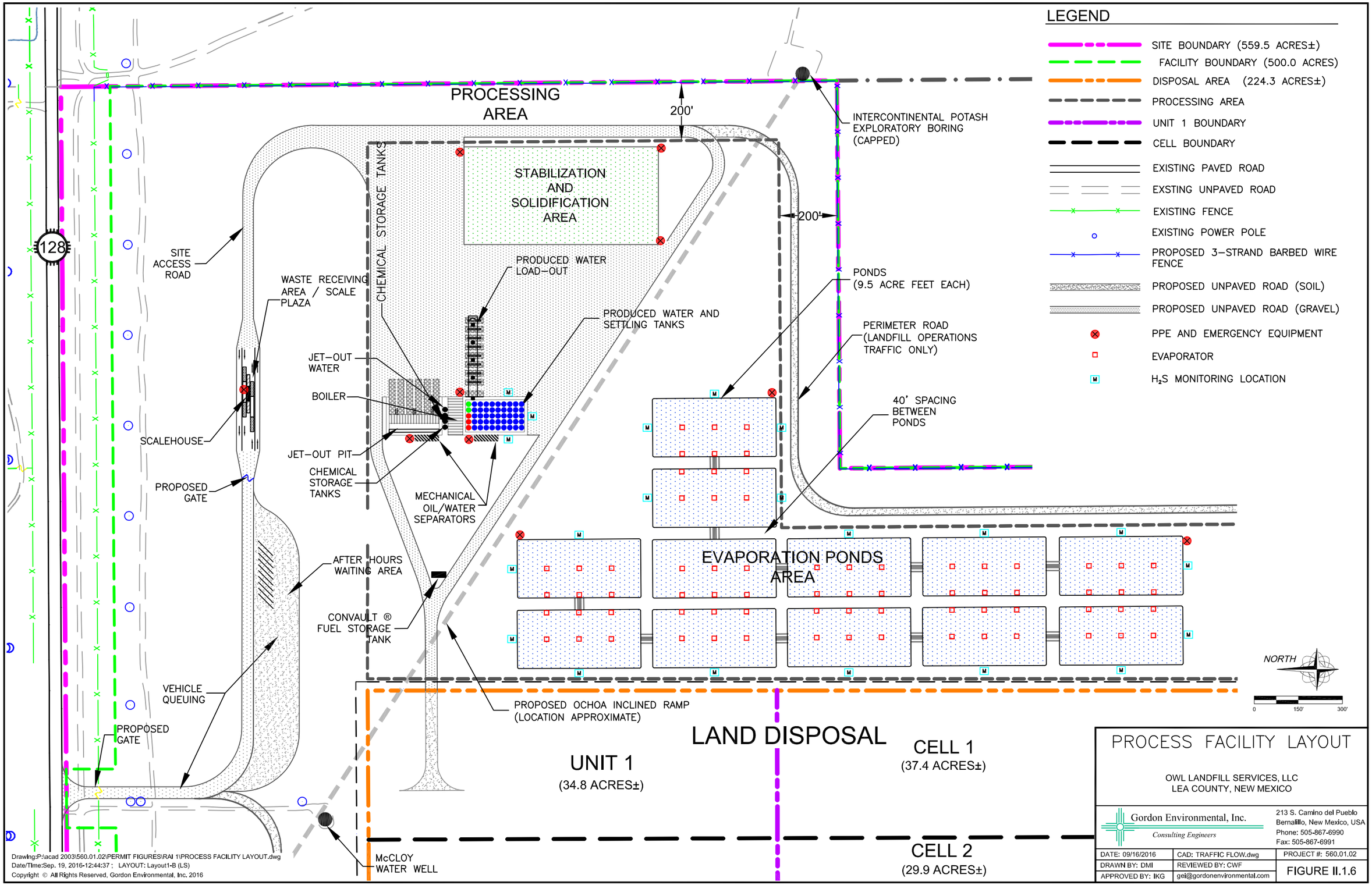
6.2 Processing

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 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 OWL 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
OWL Landfill Services, LLC

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.



PROCESS FACILITY LAYOUT

OWL LANDFILL SERVICES, LLC
LEA COUNTY, NEW MEXICO

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DATE: 09/16/2016	CAD: TRAFFIC FLOW.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: CWF	FIGURE II.1.6
APPROVED BY: IKG	gei@gordonenvironmental.com	

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The produced water processing rate is highly dependent upon evaporation, which is also influenced by climate and seasonal fluctuations (Evaporation Calculations, **Volume III.8**). 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, boilers, centrifuge, the diffused air floatation system, and mechanical evaporation systems 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).

Produced Water will be received through the Produced Waste Load-Out stations and transferred to the heated Produced Water Receiving Tanks. Oil, water and sediments will be removed as the Produced Water passes through a series of these tanks and the Treatment Plant. Water discharge from the tanks will flow through a diffused air flotation (DAF) system to remove residual oils prior to entering the evaporation ponds. The ponds will be monitored to confirm that the DAF is adequately removing oil from the liquids discharged to the pond. Oil that accumulates in the ponds will be skimmed and removed for additional processing. Oil collected from the Produced Water Receiving Tanks will be transferred to the Crude Oil Receiving Tanks for final dewatering prior to storage in the Oil Sales Tanks. Liquids within the ponds will be pumped through mechanical evaporators to dissipate the liquid to the atmosphere. As an alternative, liquids may be pumped off-site for deep well injection in units owned/operated by OWL approved for this action.

BS&W waste will be discharged to the Jet-Out Pit where solids will be allowed to settle and liquids will be removed for processing through the Produced Water processing system. Solids removed from the Jet-Out Pit will be transferred to the Stabilization and Solidification Area for processing prior to landfilling. Fresh water or recycled water will be available to flush out the tankers after they discharge their contents.

Drilling Muds and other wet solids will be deposited in the Stabilization and Solidification Area. Dry soil will be mixed with the deposited materials to solidify them to a level that will pass the Paint Filter Test (**Attachment II.1.F**). Once solidified, the resulting material will be

transported to the landfill for disposal. Liquids collected in the Stabilization and Solidification Area Sump will be transferred for processing through the Produced Water Processing System.

7.0 FACILITY INSPECTION AND MAINTENANCE

General inspection of the overall physical condition of the OWL Facility, including pond operations, treatment plant, tank farm, evaporation spray system, jet-out pit, stabilization and solidification area and the landfill will be conducted on an ongoing basis by OWL personnel when operations are active. Additional formal 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 OWL 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 lined evaporation pond area.

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 OWL Permit, with any deviations recorded and reported to the Facility

TABLE II.1.10
Facility Inspections
OWL Landfill Services, LLC

Section	Component/Details	Frequency[1]	Recording Form
7.1	**Evaporation Spray System** Weather station Plume height Over spray	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 & Pump System (Process Area)** Containment 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 Pond levees Piping condition and status	Weekly	Pond Integrity/Leak Detection Inspection Form (Attachment II.1.D)
7.7	**Solid Waste Disposal Landfill** Leachate Collection Sump	Monthly	Facility Inspection Form (Attachment II.1.C)
7.8	**Pond Containment System** Rainfall Wind speed/direction Damage assessment	Quarterly	Pond Integrity/Leak Detection Inspection Form (Attachment II.1.D)
7.9	**Landfill and Process Area** Vadoze Zone Monitoring	Monthly	Facility Inspection Form (Attachment II.1.C)

Notes:

[1] *When operations are active.*

[2] *Report discovery of liquid in the leak detection system to OCD within 24-hrs of observation.*

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 or alternative cover and need for additional cover, grading or vegetation. Deficiencies will be repaired or addressed as soon as practical, but not to exceed 30 days and the results recorded in the permanent Facility Operating Record.

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 OWL 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 processing area physically separates oil from water through the use of tanks and other equipment. Weekly inspections of the processing area and tanks 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. Pond 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 and maintained in the Facility Operating Record.

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 OWL Facility is permitted; a Spill Prevention, Control, and Countermeasures (SPCC) Plan that applies to petroleum product storage and distribution systems will be developed. Weekly 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. 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 OWL or another OCD-approved facility. A report describing subsequent investigations and remedial actions taken will be submitted to the OCD and maintained in the Facility Operating Record.

7.6 Pit and Pond Operation (Processing Area)

A thorough inspection of the leak detection system and sump will be conducted on a weekly 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 nominal liquids 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 (3/4 to 2-inch select aggregate). **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 weekly immediately after ponds are put into service and documented. Should the consistent 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, OWL 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)

The results of the corrective actions will be recorded and placed in the Facility Operating Record.

7.7 Pond Containment System (Processing Area)

A thorough inspection of the berms, the outside walls of pond levees and the west berm liner 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 30 mph for a one hour period. The inspections will be documented and retained on the Pond Integrity/Leak Detection Inspection Form such as the template 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 OWL 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.
- OWL'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

OWL is required to keep detailed records for the OWL Facility as described throughout this Application. In addition, the Facility will meet the OCD requirements for reporting as detailed in the Management Plans provided elsewhere 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.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 1: OPERATIONS, INSPECTION AND MAINTENANCE PLAN

ATTACHMENT II.1.A

SAFETY COMMUNICATIONS PROGRAM (TYPICAL)

ATTACHMENT II.1.A
Safety Communications Program (Typical)
OWL Landfill Services, LLC

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)
OWL Landfill Services, LLC

Annual Training Schedule[1]

Month	Yard Topics	Office Topics
January	Lockout/Tagout Program	Lockout/Tagout Program
	SWPPP	SWPPP
	Good Housekeeping	Good Housekeeping
	Permit Conditions	Permit Conditions
	Incompatible Waste	Incompatible Waste
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*

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 1: OPERATIONS, INSPECTION AND MAINTENANCE PLAN

ATTACHMENT II.1.B

EQUIPMENT SPECIFICATIONS

Fulton®

Thermal Fluid Heaters

Vertical Coil, Vertical Tubeless, Electric and Horizontal

Sizes from 75,000 to 40,000,000 BTU/HR

The heat transfer innovators.

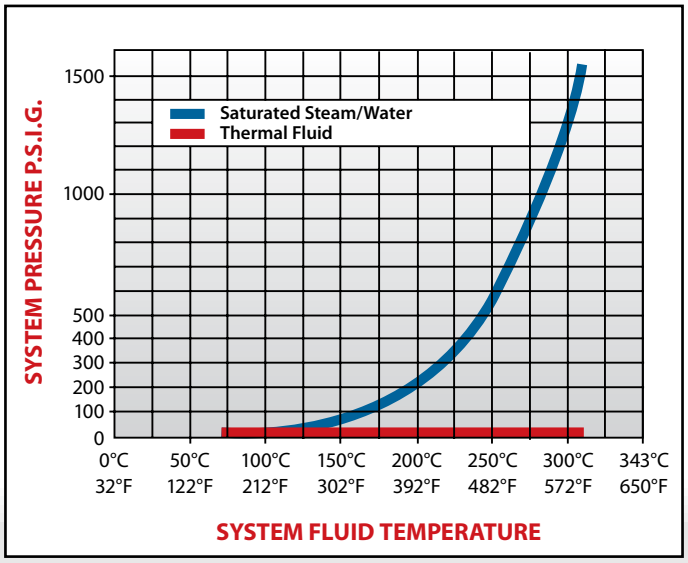
THERMAL FLUID FEATURES AND BENEFITS

KEY FEATURES

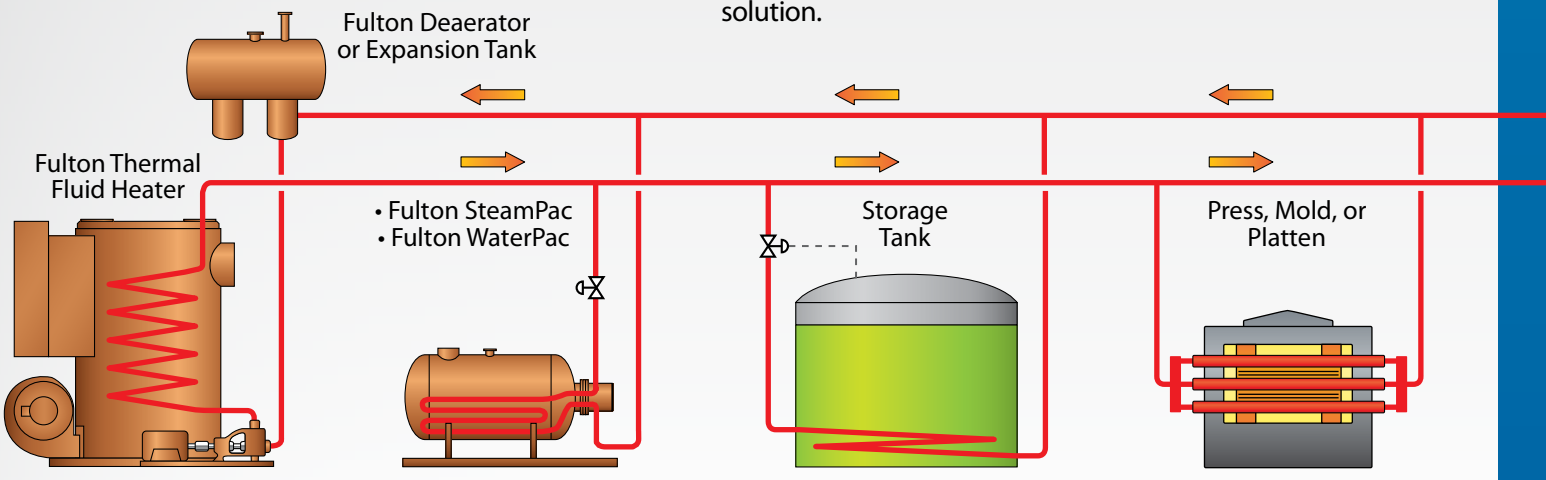
- No Corrosion or Freezing
- High Operating Temperatures (up to 750° F) with Low System Pressure
- Minimum Maintenance - Burner, Pump and Controls
- Simple Circuit; No Blow-Downs, Steam Traps or Condensate Return Systems
- Fulton's Combination Expansion / Deaerator Thermal Buffer Tank Provides Pipework Simplification, Protection of Thermal Fluid from Oxidation and Continuous Deaeration of Fluid to Avoid Pump Cavitation
- Heaters are Built and Tested to ASME Code Section VIII Div. I as standard. ASME Code Section I is available upon request
- Fulton Heaters are Manufactured Individually for Maximum Flexibility and to Customer Specifications
- Fulton Heaters and Accessory Components (Pumps, Expansion Tanks, Control Valves, etc.) Can Be Skid Mounted to Save Time and On-Site Fabrication

THERMAL FLUID VS. STEAM

A thermal fluid (hot oil) system operates in a closed loop circulation system with minimal pressure. Fulton thermal fluid systems can reach 750° F (345° C) making them an ideal choice for many process heat applications.



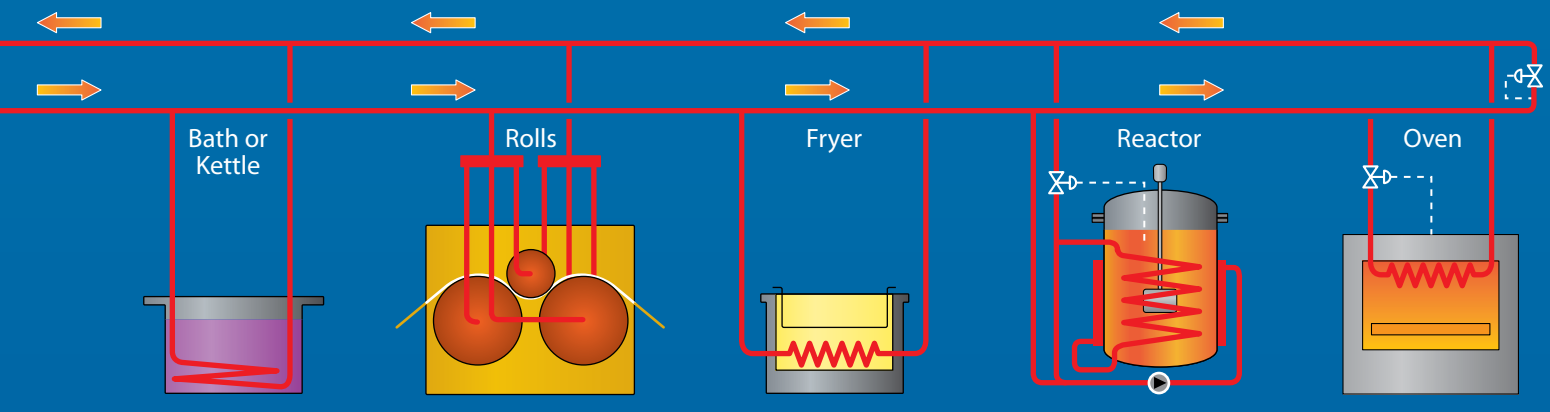
The choice between a steam system or a thermal fluid system is governed by the process requirements. The range or process temperature is a deciding factor. If the system's required temperature is above the freezing point of water (32° F) and below approximately 350° F, the choice is usually steam. However, if the required temperature is below 32° F or above 350° F, thermal fluid may be a better solution.



APPLICATIONS

Fulton heaters are used in a variety of applications throughout many industries. Food, plastic and chemical processing, as well as pharmaceutical and bio-fuel production, are only a few examples of the many existing applications using Fulton equipment.

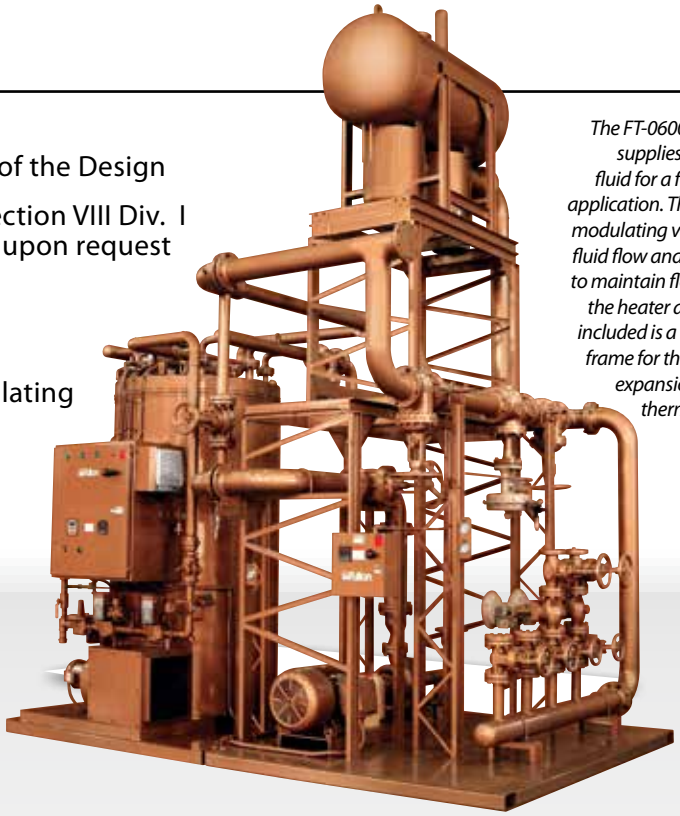
- Adhesives
- Asphalt
- Autoclaves
- Bio-fuel
- Chemical Reactors
- Deodorization
- Distillation
- Food Processing (frying, baking, etc.)
- Gas Processing / Oil Processing
- Inks & Dyes
- Laminating
- Laundry
- Marine Heating and Shipboard Services
- Metal Finishing
- Mining
- Ovens
- Paint and Varnish Manufacture
- Paper Converting Machinery
- Plastics
- Printing and Packaging Machinery
- Rubber and Rubber Compounds
- Surface Pre-Treatment and Finishing
- Tank Farms/Pipe and Pump Tracing
- Textile Machinery
- Unfired Steam or Hot Water Generation
- Uranium Processing
- Waste Treatment/Dryers



C-MODEL
VERTICAL COIL DESIGN

KEY FEATURES

- Vertical 4-Pass Design
- Preheated Combustion Air is an Integral Part of the Design
- Heaters are Built and Tested to ASME Code Section VIII Div. I as standard. ASME Code Section I is available upon request
- 800,000 BTU/Hr to 14,000,000 BTU/Hr Output
- Operating Temperatures to 750° F
- Gas, Oil or Dual Fuel Burners; On/Off or Modulating
- Low Emission Natural Gas Burners are Available
- Minimal Refractory Results in Low Thermal Inertia and Prevents Overheating of the Fluid in the Event of a Pump or Power Failure
- Customized Controls Available
- Customized Heaters Available
- High Efficiencies
- Even Heating



The FT-0600-C shown here supplies 600° F thermal fluid for a food processing application. The skid includes modulating valves to control fluid flow and a bypass valve to maintain flow throughout the heater at all times. Also included is a custom 3-piece frame for the top-mounted expansion / deaerator / thermal buffer tank.

MODELS	FT-C	0080	0120	0160	0240	0320	0400	0600	0800	1000	1200	1400
Specifications												
Heat Output	1,000 BTU/HR	800	1,200	1,600	2,400	3,200	4,000	6,000	8,000	10,000	12,000	14,000
	1,000 KCAL/HR	200	300	400	600	800	1,000	1,500	2,000	2,500	3,000	3,500
Thermal Fluid Content	Gallons	10	21	19	31	68	76	132	201	290	383	460
	Liters	38	80	72	116	258	288	498	648	1,097	1,448	1,741
Recommended Flow Rate	GPM	50	75	100	150	250	250	375	500	615	730	800
	M3/HR	11.4	17	22.7	34	56.8	56.8	85.2	113.6	139	167	182
Approximate Fuel Usage												
Light Oil *	GPH	7.1	10.7	14.3	21.4	28	35.3	53	69.3	87.1	104.5	122
	LPH	27	40.6	54.1	81	108.8	136	201	263.7	329.6	395.5	461.5
Natural Gas *	FT3/HR	998	1,498	1,998	2,999	4,000	4,997	7,498	9,997	12,496	14,998	17,500
	M3/HR	38.3	42.4	56.5	84.9	113.2	141.5	212.3	283	353.8	424.6	495.5
Power												
Typical Circulating Pump	HP	10	10	15	15	20	20	30	40	50	50	60
	KW	7.5	7.5	11.2	11.2	14.9	14.9	22.5	29.5	37.3	37.3	45
Typical Burner Motor	HP	1.5	3	3	3	5	7.5	7.5	15	20	20	20
	KW	1.1	2.2	2.2	2.2	3.7	5.6	5.6	11.2	11.2	15	15

* Please consult factory for additional fuel options. Fuel up to No. 6 Oil available for large units (FT-0600-C and larger). Voltage 3 Phase for Burner and Pump - Each unit has an incorporated step down transformer. Efficiency up to 80% Minimum Based on High Heating Value of the Fuel (No. 2 Oil @ 140,000 BTU/GHHV; Natural Gas @ 1,000 BTU/ft3HHV) Circulating pump motor sizes based on standard pressure (55 PSIG) and viscosity 1 cs, specific gravity 0.7, with 25-37 PSID available head for installation. All Units are Modulated. Operating specifications may change based on field conditions.

A LOOK INSIDE

THE COMBUSTION PROCESS

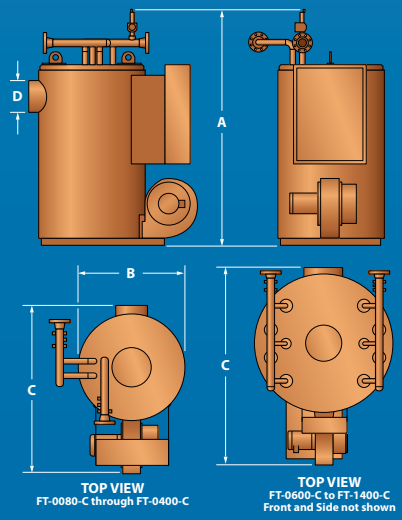
1 The combustion air enters the burner fan inlet, travels upward between the inner and outer jacket, preheating the air before it enters the top mounted burner.

2 Hot gases travel down the full length of the vessel creating the first (radiant) pass.

3 The gases then travel back across the inner row of coils, creating the second (convection) pass.

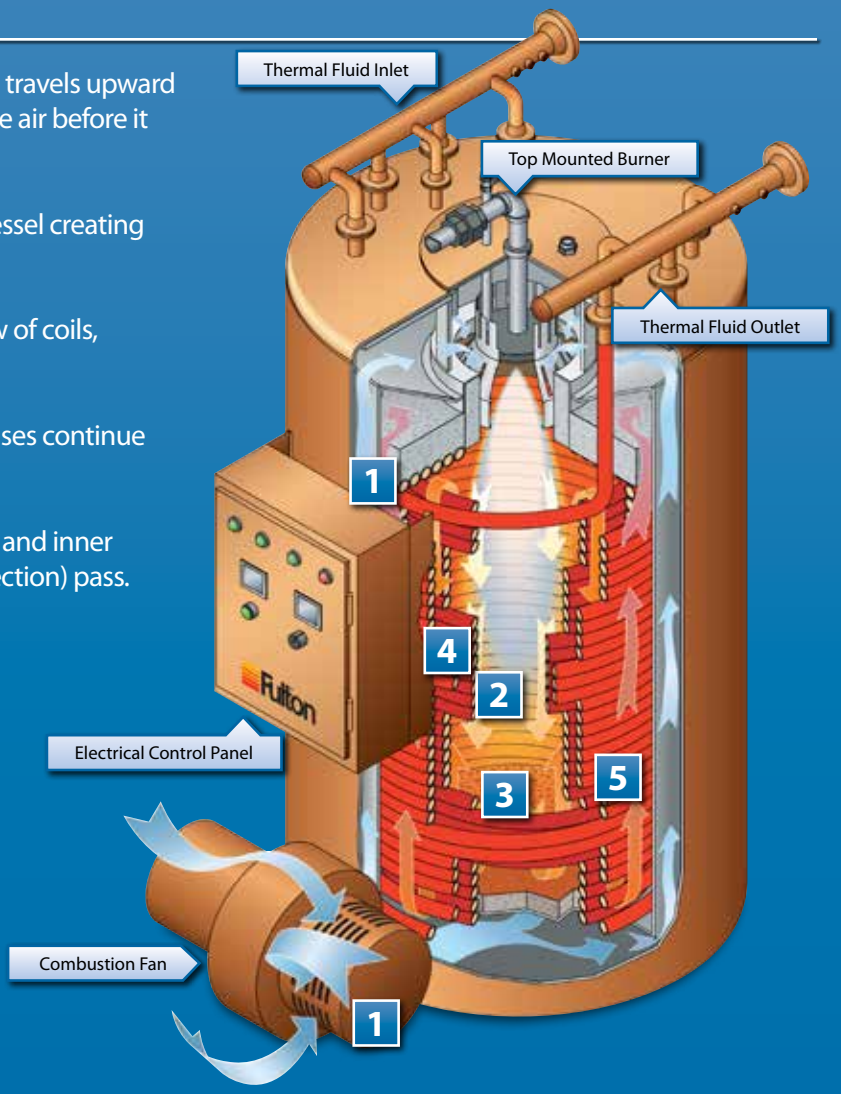
4 The third (convection) pass is created as the gases continue back down between the inner and outer coil.

5 The last pass is upward between the outer coil and inner jacket to the flue outlet, creating the fourth (convection) pass.



TOP VIEW
FT-0080-C through FT-0400-C

TOP VIEW
FT-0600-C to FT-1400-C
Front and Side not shown



MODELS	FT-C	0080	0120	0160	0240	0320	0400	0600	0800	1000	1200	1400
Dimensions												
Heater Inlet/Outlet Connections	IN	1.25	1.5	2	2.5	3	3	4	4	6	6	6
	MM	32	38	51	64	76.3	76	102	102	152	152	152
(A) Overall Height	IN	73.7	80.7	80.6	89.7	100.6	112.4	143.6	143	146.5	146.4	163.1
	MM	1,872	2,050	2,046	2,278	2,556	2,856	3,648	3,632	3,721	3,718	4,144
(B) Heater Width	IN	31.6	34.4	45.9	50.1	49.3	49.3	63.4	70.5	95	108.4	108.4
	MM	803	873	1,165	1,273	1,252	1,252	1,611	1,791	2,413	2,753	2,753
(C) Overall Depth	IN	46.2	60.6	60.6	66.6	80.6	80.6	88.1	107.75	135.1	152.9	152.9
	MM	1,173	1,540	1,540	1,691	2,046	2,046	2,237	2,736	3,432	3,882	3,882
(D) Flue Outlet Diameter	IN	10	10	10	12	14	14	18	20	20	22	22
	MM	254	254	254	305	356	356	457	508	508	559	559
Recommended Stack Diameter	IN	10	12	12	14	18	18	22	24	24	26	26
	MM	254	304	304	356	457	457	558	609	609	661	661
Approximate Dry Weight	LB	1,500	2,100	2,550	3,400	5,300	5,300	8,250	11,450	19,250	21,700	23,000
	KG	700	950	1,150	1,550	2,400	2,400	3,750	5,200	8,750	9,850	10,455

Specifications and Dimensions are approximate. Consult factory for model specific electrical requirements. We reserve the right to change specifications and/or dimensions without notice. Diagram for guidance purposes only. Comprehensive details of dimensions, connections, etc. for each model are given on product dimension data sheets available from Fulton.

A-MODEL
VERTICAL TUBELESS DESIGN

KEY FEATURES

- Vertical Annular Design
- Heaters are Built and Tested to ASME Code Section VIII Div. I as standard. ASME Code Section I is available upon request
- 207,000 BTU/Hr to 1,736,000 BTU/Hr Output
- Operating Temperatures to 600° F
- Gas or Oil Fired Burners, On/Off or Modulating
- Low Emission Gas Burners are Available
- Customized Controls Available
- Customized Heaters Available

Pictured here is a skid mounted FT-0690-A thermal fluid heater with a deaerator / thermal buffer tank and a circulation pump.

MODELS	FT-A	0200	0380	0520	0690	1050	1740
Specifications							
Heat Output	1,000 BTU/HR	207	348	519	693	1,052	1,736
	1,000 KCAL/HR	52	88	131	175	265	437
Thermal Fluid Content	Gallons	23	38	45	65	98	117
	Liters	87	144	170	246	371	443
Recommended Flow Rate	GPM	90	90	125	125	150	200
	M3/HR	21	21	28	28	34	46
Approximate Fuel Usage • Light Oil	GPH	2.2	3.2	4.7	6.7	9.4	15.8
	LPH	8.3	11.9	17.8	25.4	35.6	60
Approximate Fuel Usage • Natural Gas	FT3/HR	259	435	649	866	1,315	2,170
	M3/HR	7.2	12.2	18.4	24.2	36.8	60.8
Power							
Typical Circulating Pump	HP	10	10	15	15	15	20
	KW	7.5	7.5	11.2	11.2	11.2	14.9
Typical Burner Motor	HP	.33	.33	.33	.75	.75	1.5
	KW	.248	.248	.248	.56	.56	1.1

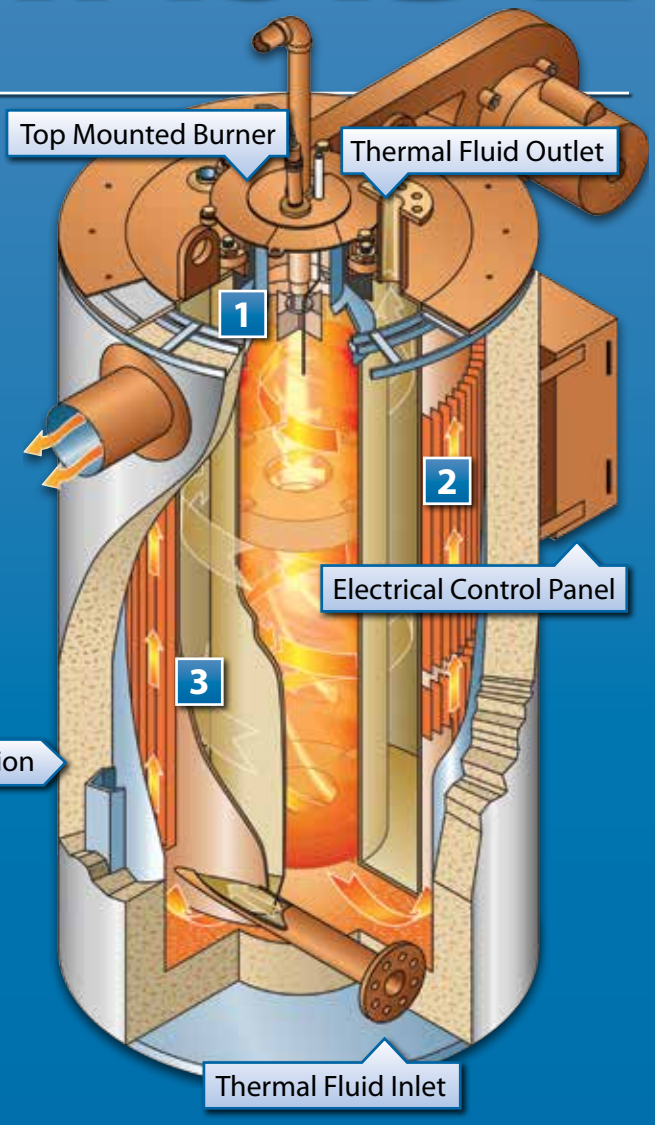
A LOOK INSIDE

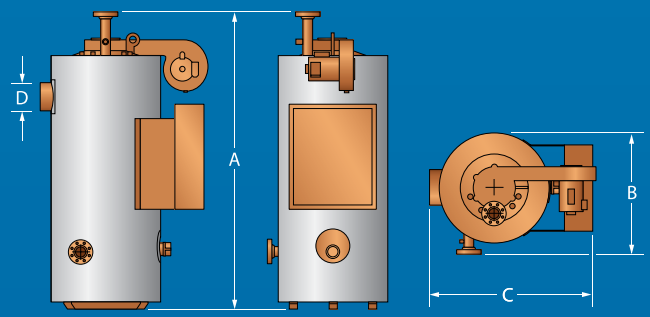
THE COMBUSTION PROCESS

1 The top-mounted down-fired burner delivers a spinning flame down the length of the furnace. As the flame swirls downward in a controlled flow pattern, the fluid spirals upward in the pressure vessel.

2 Hot gases from the flame are carried up the outside of the vessel in the secondary flue passage convection area.

3 Convection fins welded along the full length of the vessel transmit the remaining heat through the outer side of the fluid vessel and into the fluid. The result is even heating of thermal fluids for optimum thermal efficiency.





Specifications and Dimensions are approximate. Consult factory for model specific electrical requirements. We reserve the right to change specifications and/or dimensions without notice.

Diagram for guidance purposes only. Comprehensive details of dimensions, connections, etc. for each model are given on product dimension data sheets available from Fulton.

MODELS	FT-A	0200	0380	0520	0690	1050	1740
Dimensions							
Heater Inlet/Outlet Connections	IN	1.5	1.5	2	2	2	2.5
	MM	38	38	51	51	51	64
(A) Overall Height	IN	69	75	85	86	86	110
	MM	1,752	1,905	2,159	2,185	2,185	2,794
(B) Heater Width	IN	26	28	30	36	44	44
	MM	660	710	760	915	1,120	1,120
(C) Overall Depth	IN	43	45.5	46	56	64	64
	MM	1,092	1,156	1,168	1,422	1,626	1,626
(D) Flue Outlet Diameter	IN	6	6	8	10	12	12
	MM	152	152	203	254	305	305
Approximate Dry Weight	LB	1,850	2,100	2,300	3,400	4,400	7,200
	KG	840	955	1,045	1,540	1,995	3,275

N-MODEL
VERTICAL ELECTRIC DESIGN

KEY FEATURES

- Compact Vertical Design
- Heaters are Built and Tested to ASME Code Section VIII Div. I as standard. ASME Code Section I is available upon request
- 74,000 BTU/Hr to 1,685,000 BTU/Hr Output
- Operating Temperatures to 650° F
- Low Watt Density Elements Result in Low Film Temperatures and Long Element Life
- Customized Controls Available, Including (but not limited to) Class 1, Division 1 or 2 groups C&D of NEC Code
- Customized Heaters Available

Pictured here is a skid mounted FT-0640-N electric thermal fluid heater with an expansion / deaerator / thermal buffer tank and a circulation pump.

MODELS	FT-N	0075	0150	0225	0300	0375	0430	0640	0860	1070	1290	1500	1720
Specifications													
	KW	22	44	66	88	110	126	189	252	315	378	441	504
Heat Input	1,000 BTU/HR	75	150	225	300	375	429	644	859	1,074	1,289	1,504	1,719
	1,000 KCAL/HR	18.9	37.8	56.7	75.6	94.5	108	162	216	271	325	379	433
Heat Output	1,000 BTU/HR	74	148	222	294	368	420	631	842	1,053	1,263	1,474	1,685
	1,000 KCAL/HR	18.6	37.3	59.9	74.1	92.7	105.8	159	212.2	265.4	318.3	371.4	424.6
Thermal Fluid Content	Gallons	18	36	42	54	63	79	79	102	127	152	168	185
	Liters	68	136	159	204	238	299	299	386	480	575	636	700
Recommended Flow Rate	GPM	50	50	50	90	90	125	125	150	150	175	200	200
	M3/HR	11.4	11.4	11.4	20.5	20.5	28.4	28.4	34	34	39.8	45.5	45.5
Power													
Typical Circulating Pump Motor	HP	7.5	7.5	7.5	10	10	15	15	15	15	15	20	20
	KW	5.6	5.6	5.6	7.5	7.5	11.2	11.2	11.2	11.2	11.2	14.9	14.9
Amps	208V	61	122	183	245	306	350	525	700	875	1,050	1,224	1,399
	220V	53	106	159	212	265	303	455	607	758	910	1,061	1,212
	480V	26	53	79	106	132	151	228	303	379	455	531	606

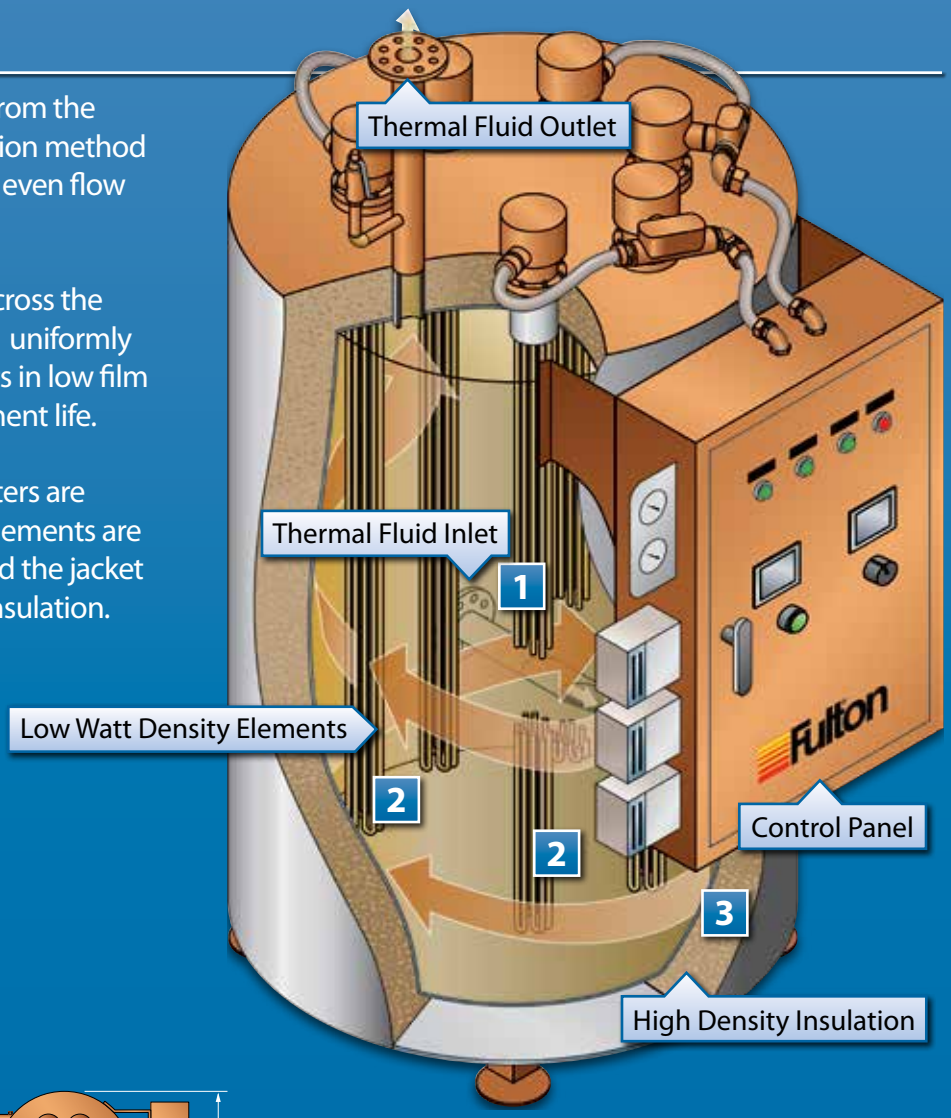
A LOOK INSIDE

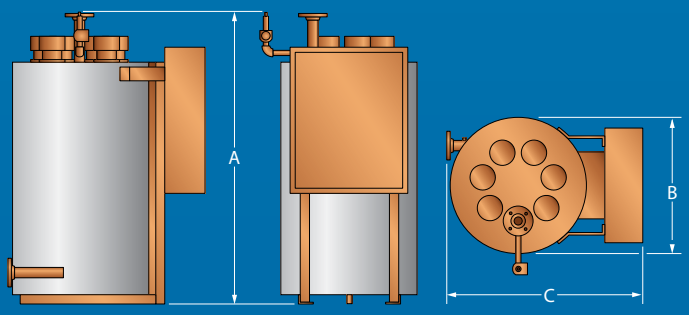
OPERATING PRINCIPLE

1 Thermal fluid enters the heater from the lower right side. This unique circulation method (upward spiraling fluid) results in an even flow of thermal fluid within the vessel.

2 The thermal fluid flows evenly across the multiple low watt density elements, uniformly heating the thermal fluid. This results in low film temperatures and assures long element life.

3 Fulton electric thermal fluid heaters are nearly 100% efficient because the elements are totally immersed in thermal fluid and the jacket is fully insulated with high density insulation.





Specifications and Dimensions are approximate. Consult factory for model specific electrical requirements. We reserve the right to change specifications and/or dimensions without notice.

Diagram for guidance purposes only. Comprehensive details of dimensions, connections, etc. for each model are given on product dimension data sheets available from Fulton.

MODELS	FT-N	0075	0150	0225	0300	0375	0430	0640	0860	1070	1290	1500	1720
Dimensions													
Heater Inlet	IN	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2	2.5	2.5
	MM	38	38	38	38	38	51	51	51	51	51	64	64
(A) Overall Height	IN	70	70	70.5	70	70	90.5	90.4	90.8	89.8	91.2	93	93
	MM	1,778	1,778	1,791	1,778	1,778	2,299	2,296	2,306	2,281	2,317	2,362	2,362
(B) Heater Width	IN	20	26	28	32	32	32	32	38	44	50	54	58
	MM	508	660	711	813	813	813	813	965	1,118	1,270	1,372	1,473
(C) Overall Depth	IN	37.5	43	43.5	47.5	47.5	47.5	49.5	53.8	58.4	65.7	71.8	75.7
	MM	953	1,092	1,105	1,207	1,207	1,207	1,257	1,365	1,257	1,669	1,823	1,993
Approximate Dry Weight	LB	1,060	1,220	1,400	1,540	1,660	2,040	2,200	2,370	2,650	2,950	2,950	3,600
	KG	481	555	636	700	756	927	1,000	1,077	1,205	1,341	1,341	1,636

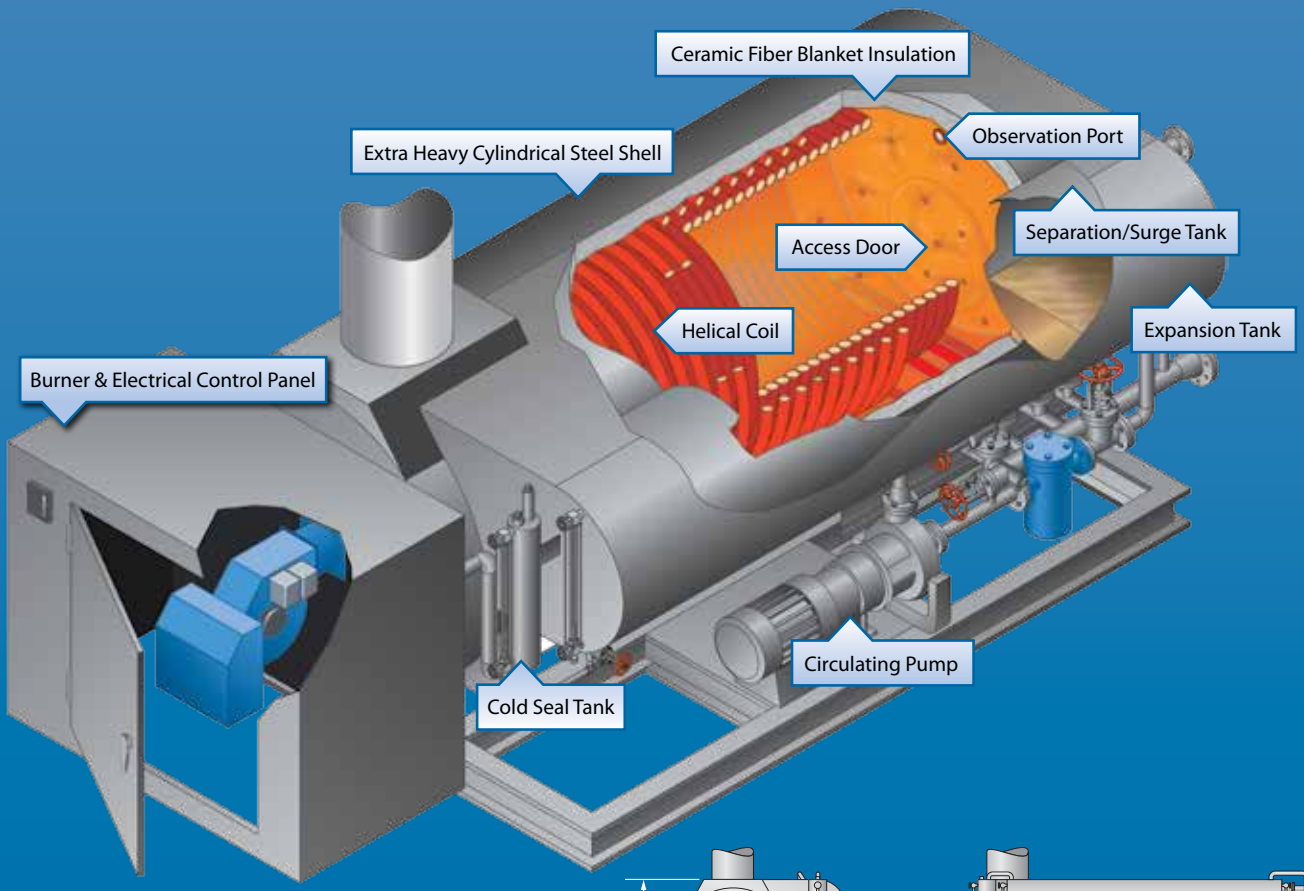
HOPKINS
HORIZONTAL COIL DESIGN

KEY FEATURES

- Horizontal 2-Pass Design
- 1,000,000 BTU/Hr to 40,000,000 BTU/Hr Output
- Heaters are Built and Tested to ASME Code Section VIII Div. I as standard. ASME Code Section I is available upon request
- Operating Temperatures to 650° F
- Modulating Gas, Oil or Dual Fuel Burners
- Alternative Fuel Capabilities
- Open Protocol Burner
- Skid-Mounted Systems Available, Including Circulating Pump and Expansion Tank
- Customized Controls and Coil Designs Available
- Water - Glycol Heaters Available
- Available With or Without Integral Expansion Tank

MODELS	HPN	100S	200S	350S	600S	800S	1000S	1200S	1400S	1600S	2000S	2400S	3000S	4000S
Specifications														
Heat Output	Million BTU/hr	1	2	3.5	6	8	10	12	14	16	20	24	30	40
	Million Kcal/hr	.25	.5	.875	1.5	2	2.5	3	3.5	4	5	6	7.5	10
Flow Rate-Standard *1	GPM	75	150	265	425	600	725	900	1050	1200	1500	1800	2250	3000
	M3/min	18	35	61	97	137	165	205	239	273	341	409	511	682
Flow Rate-Low Flow *2	GPM	40	75	135	225	300	375	450	525	600	750	900	1125	1500
	M3/min	10	18	31	52	69	86	103	120	97	171	205	256	341
Circulating Pump Motor-STD	HP	7.5	15	20	30	40	50	60	75	100	100	125	150	200
	kW	5.6	11.2	14.9	22.5	29.8	37.3	45	56	74.5	74.5	93.2	111.8	149
Circulating Pump Motor-LF	HP	7.5	7.5	15	20	30	30	40	30	40	50	60	75	100
	kW	5.6	5.6	11.2	14.9	22.5	22.5	29.8	22.5	29.8	37.3	45	56	74.5
Blower Motor	HP	1/3	1	2	7.5	10	10	5	7.5	7.5	15	20	25	30
	kW	.25	.7	1.5	5.6	7.5	7.5	4.3	5.6	5.6	11.2	14.9	18.6	22.5
Light Oil (approx. fuel usage)*3	GPH	8.8	17.5	30.6	52.5	70	87.5	104.9	122.4	139.9	174.9	209.8	262.3	349.7
	LPH	33.3	66.2	115.8	198.7	265	331.2	397	463.3	529.5	662	794	992.8	1324
Natural Gas (approx. fuel usage)*3	FT3/hr	1,334	2,667	4,667	8,000	10,667	13,334	16,000	18,667	21,334	26,667	32,000	40,000	53,334
	M3/hr	37.4	75	131	224	299	373.4	448	522.7	597.4	747	896	1120	1493.4

A LOOK INSIDE



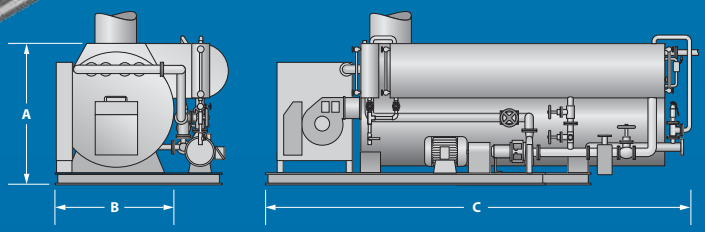


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Diagram for guidance purposes only. Comprehensive details of dimensions, connections, etc. for each model are given on product dimension data sheets available from Fulton.

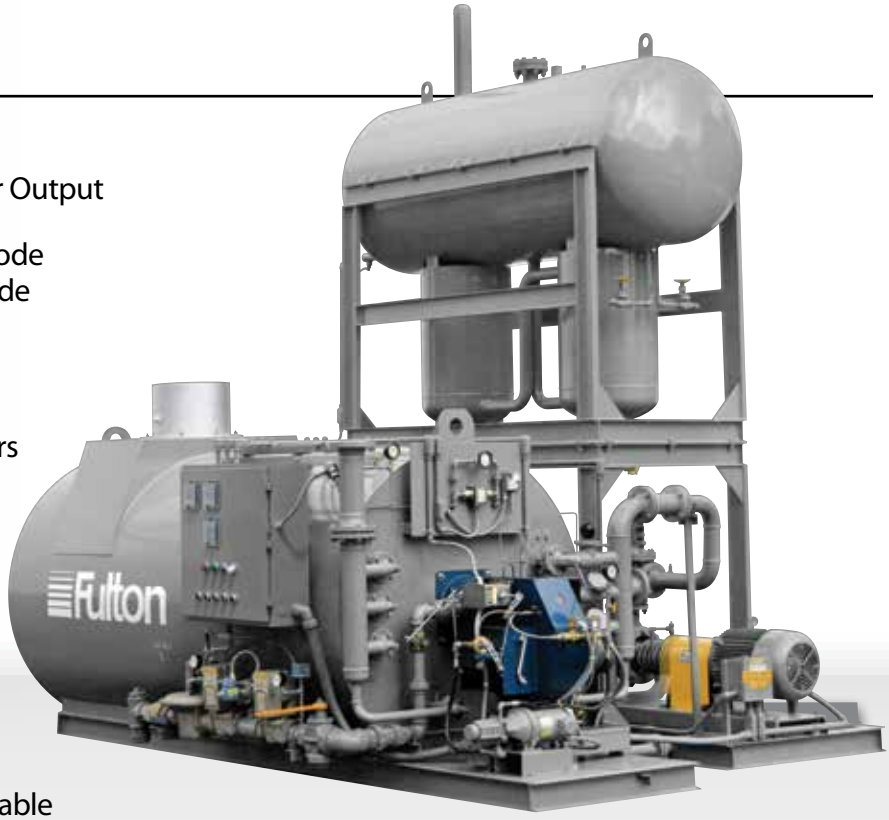
***NOTE:** Dimensions shown are for the Hopkins model without the integral expansion tank.

MODELS	HPN	100S	200S	350S	600S	800S	1000S	1200S	1400S	1600S	2000S	2400S	3000S	4000S
Dimensions														
(A) Overall Height (w/o Stack)	IN	51	60	62	82	82	105	105	106	106	125	133	133	142
	MM	1,295.4	1,524	1,575	2,083	2,083	2,667	2,667	2,692.4	2,692.4	3,175	3,378	3,378	3,607
(B) Overall Width	IN	42	50	50	74	93	87	103	110	110	123	130	130	142
	MM	1,067	1,270	1,270	1,880	2,362	2,210	2,617	2,794	2,794	3,124	3,302	3,302	3,607
(C) Overall Length	IN	115	152	211	231	302	311	360	408	444	450	550	575	648
	MM	2,921	3,861	5,359	5,867	7,671	7,899	9,144	10,363	11,278	11,430	13,970	14,605	16,459
Inlet/Outlet Connections	IN	2	3	3	4	6	6	8	8	8	10	12	12	12
	MM	51	76.2	76.2	102	152.4	152.4	203	203	203	254	305	305	305
Thermal Liquid Volume	Gallons	45	86	168	426	661	724	853	1,168	1,400	1,721	2,322	3,180	4,626
	Liters	170	325	635	1,612	2,502	2,740	3,228	4,421	5,299	6,514	8,789	12,037	17,511
Approx. Dry Weight	LB	3,936	6,800	9,052	14,350	18,500	23,100	26,800	30,500	32,600	41,400	68,000	74,000	80,000
	KG	1,785	3,084	4,106	6,509	8,392	10,478	12,156	13,835	14,787	18,779	30,844	33,566	36,287
Approx. Flooded Weight	LB	4,310	7,514	10,447	17,886	23,987	29,110	33,880	40,195	44,220	55,685	87,273	100,394	118,396
	KG	1,955	3,408	4,739	8,113	10,880	13,204	15,368	18,232	20,058	25,258	39,586	45,538	53,704
Floor Loading	LB/FT3	129	143	143	151	123	155	132	129	131	145	176	194	186
	KG/M3	2,066	2,291	2,291	2,419	1,970	2,483	2,115	2,066	2,099	2,323	2,819	3,108	2,980

ALLIANCE
HORIZONTAL COIL DESIGN

KEY FEATURES

- Compact Horizontal 3-Pass Design
- 2,400,000 BTU/Hr to 20,000,000 BTU/Hr Output
- Heaters are Built and Tested to ASME Code Section VIII Div. I as standard. ASME Code Section I is available upon request.
- Operating Temperatures to 650° F
- Modulating Gas, Oil or Dual Fuel Burners
- Low Emission Gas Burners
- Alternative Fuel Capabilities
- Open Protocol Burner
- Skid Mounted Systems Available, Including Circulating Pump and Expansion Tank
- Customized Controls and Heaters Available



Shown here is an FT-0600-HC horizontal heater skid mounted with circulation pump and a combination expansion / deaerator / thermal buffer tank, designed for barge cargo heating.

MODELS	HC	0240	0400	0600	0800	1000	1200	1600	2000
Specifications									
Heat Output	1,000 BTU/HR	2,400	4,000	6,000	8,000	10,000	12,000	16,000	20,000
	1,000 KCAL/HR	600	1,000	1,500	2,000	2,500	3,000	4,032	5,040
Thermal Fluid Content	Gallons	75	115	190	264	325	508	480	1,150
	Liters	284	435	719	998	1,230	1,921	1,817	4,353
Recommended Flow Rate	GPM	150	300	400	600	850	1,200	1,200	1,500
	M3/HR	35	69	91	137	193	273	273	341
Approximate Fuel Usage									
Light Oil	GPH	23	39	58	77	96	115	143	179
	LPH	88	148	220	292	364	436	542	678
Natural Gas	FT3/HR	3,200	5,340	8,000	10,700	13,340	16,000	20,000	25,000
	M3/HR	91	152	227	304	378	454	566	708
Power									
Typical Circulating Pump Motor	HP	15	25	30	50	60	75	100	125
	KW	11.2	18.7	22.5	37.3	45	56	74.5	93.2
Typical Burner Motor	HP	2	5	7.5	10	15	15	30	30
	KW	1.5	3.7	5.6	7.5	11.2	11.2	22.4	22.4

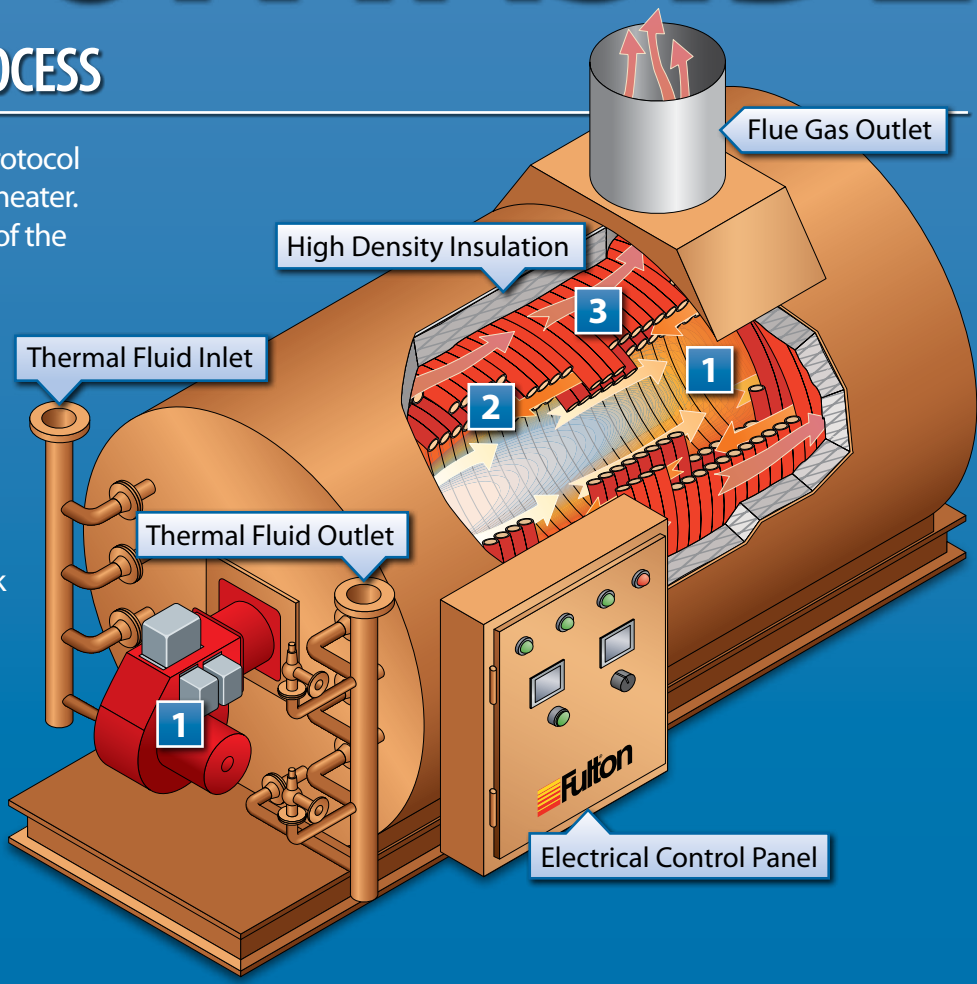
A LOOK INSIDE

THE COMBUSTION PROCESS

1 Air and fuel mix in the open protocol burner located at the front of the heater. The burner fires down the center of the vessel forming the first pass.

2 The hot gases turn at the rear of the vessel and return between two rolls of coils to the front end plate forming the second pass.

3 The hot gases then flow along the outside of the coils to the back of the heater, forming the third pass and then exit out the flue.



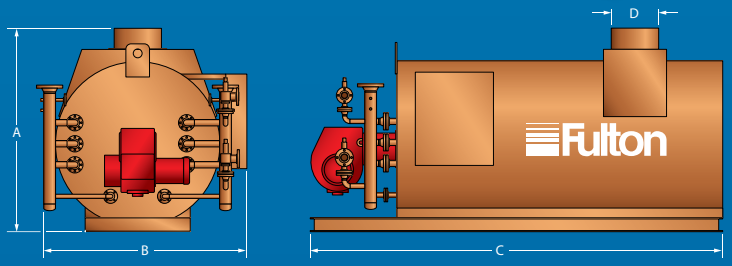


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Diagram for guidance purposes only. Comprehensive details of dimensions, connections, etc. for each model are given on product dimension data sheets available from Fulton.

MODELS	HC	0240	0400	0600	0800	1000	1200	1600	2000
Dimensions									
Heater Inlet/Outlet Connections	IN	2.5	3	4	6	6	6	8	8
	MM	64	76	102	152	152	152	203	203
(A) Overall Height	IN	64	68	78	107	107	131	114	118
	MM	1,626	1,727	1,981	2,718	2,718	3,327	2,896	2,997
(B) Heater Width	IN	62	62	81	95	95	130	118.5	119.5
	MM	1,575	1,575	2,057	2,413	2,413	3,302	3,010	3,035
(C) Overall Depth	IN	134	137	157	208	182	240	327	351
	MM	3,404	3,480	3,988	4,623	4,623	6,096	8,306	8,915
(D) Flue Outlet Diameter	IN	12	14	18	22	22	22	36	36
	MM	305	356	457	559	559	559	914	914
Approximate Dry Weight	LB	5,000	7,500	9,500	12,500	19,250	21,700	39,000	39,000
	KG	2,272	3,409	5,455	5,682	8,750	9,864	17,728	17,728

UNFIRED STEAM AND HOT WATER GENERATORS

STEAM GENERATOR KEY FEATURES

- Vertical Design 10 HP to 100 HP
- Horizontal Design 70 HP to 415 HP (Custom sizes are available)
- Standard Designs 15 PSIG to 150 PSIG (custom operating pressures are available)
- Built and Stamped to ASME Code Section VIII Div. I
- Complete with Modulating Thermal Fluid Control Valve and Custom Control Panel
- May be Skid Mounted with Blowdown Separators, Return Tanks, Deaerator Tanks, Feedwater Pumps, Chemical Tanks and Water Softeners

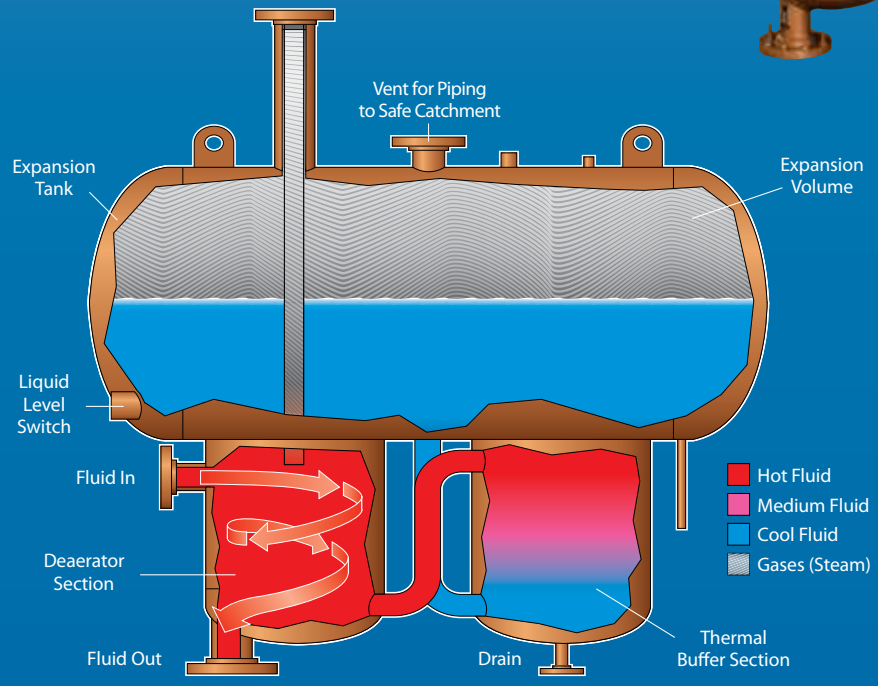
HOT WATER GENERATOR KEY FEATURES

- Custom Designs Available
- Carbon Steel or Stainless Steel
- Built and Stamped to ASME Code Section VIII Div. I
- Complete with Modulating Thermal Fluid Control Valve
- Instantaneous Hot Water Generation, or Can Be Used with a Storage Tank

EXPANSION/DEAERATOR/ THERMAL BUFFER TANK

KEY FEATURES

- Designed to Work as an Open-Atmospheric System Where Applicable, Eliminating the Expense of an Inert Gas Blanket
- Continuous Deaeration of Steam and Other Non-Condensibles
- Protects Fluid from Oxidation
- Simplification of Pipework
- Ease of Installation
- Standard 2-Pipe Expansion Tanks also Available



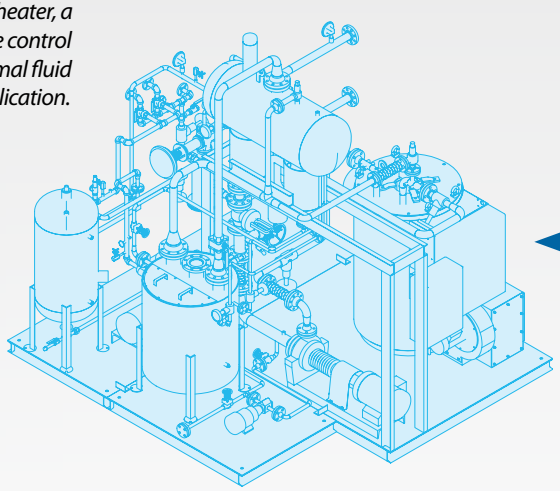
MODELS	FT-L	0200	0500	1000	1500	2000	3000	5000
Tank Sizing and Capacities								
Capacity	Gallons	52	132	264	397	528	793	1,310
	Liters	196	499	999	1,502	1,998	3,001	4,958
Initial Fill	Gallons	25	40	80	90	145	215	300
	Liters	94	151	302	340	548	813	1,135
Available for Expansion	Gallons	46	121	232	380	444	717	1,168
	Liters	174	458	878	1,438	1,680	2,714	4,421
Max System Volume	Gallons	184	525	1,000	1,400	1,700	2,600	4,600
	Liters	696	1,987	3,785	5,299	6,435	9,842	17,412
Dry Weight	LB	636	970	1,350	1,710	2,550	3,200	5,300
	KG	289	440	612	776	1,134	1,451	1,637

CUSTOM ENGINEERED SKIDDED SYSTEMS

Fulton's engineering and design capabilities are unmatched in the industry, providing comprehensive solutions to custom-designed thermal fluid systems. Our team of engineers and project managers assist in the specification and design of a "turnkey" system for each application. All engineered systems come with state-of-the-art operating controls and can have single-point electric, fuel supply, thermal fluid drain/fill, inlet/outlet, and any other applicable connection. From design to complete fabrication, trust Fulton and our many years of experience to build a system you can rely on for years to come.

The skid system shown here included one FT-0240-C heater, a circulating pump, expansion tank and a temperature control unit (TCU). This system was designed to provide thermal fluid and hot water to several dryers for a wastewater application.

This system includes two FT-0600-C thermal fluid heaters skid mounted with three circulating pumps (one pump acts as a backup for either heater), and one FT-5000-L expansion tank (not shown). These heaters are used to provide process heat for the manufacture of asphalt roofing shingles.



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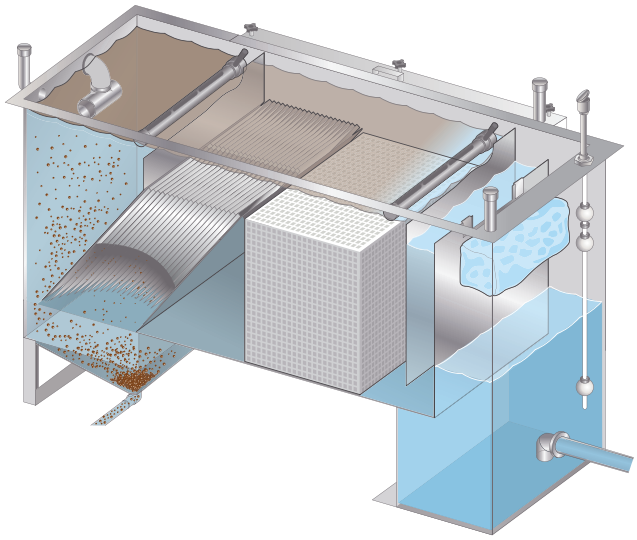
FTC-BRO_2013-1218

Clarification Separator

A HIGH-EFFICIENCY OIL WATER SEPARATOR

- Reduces coalescing media failure
- Reduces pretreatment needs
- Reduces posttreatment needs
- Lowers total cost of ownership



HQI Clarification Separator is recommended for any application that has oil and a high concentration of settleable and suspended solids.

DESIGN

The HQI Clarification Separator is a horizontal gravity flow pretreatment solution designed to separate settleable solids (specific gravity greater than water), suspended solids (specific gravity the same as water), and free and dispersed (non-emulsified) oil.

Units are built out of stainless steel or carbon steel. We offer several coating solutions for your specific application, such as brine water or frac water.

For a full list of options, such as pump packages and control panels, see: www.hydroquipinc.com/HQI-CS

Our Clarification Separator, when used in conjunction with posttreatment filtration, such as reverse osmosis (RO), dissolved air flotation (DAF) or electrocoagulation (EC), treats wastewater so it can be recycled or discharged.

This unit lowers the total cost of ownership of the entire water treatment system by:

- preventing large amounts of solids from entering coalescing chamber, reducing coalescing media failure.
- eliminating need of inefficient settling basins or frac tanks prior to treatment process.
- decreasing amount of carry-over entering into posttreatment process.

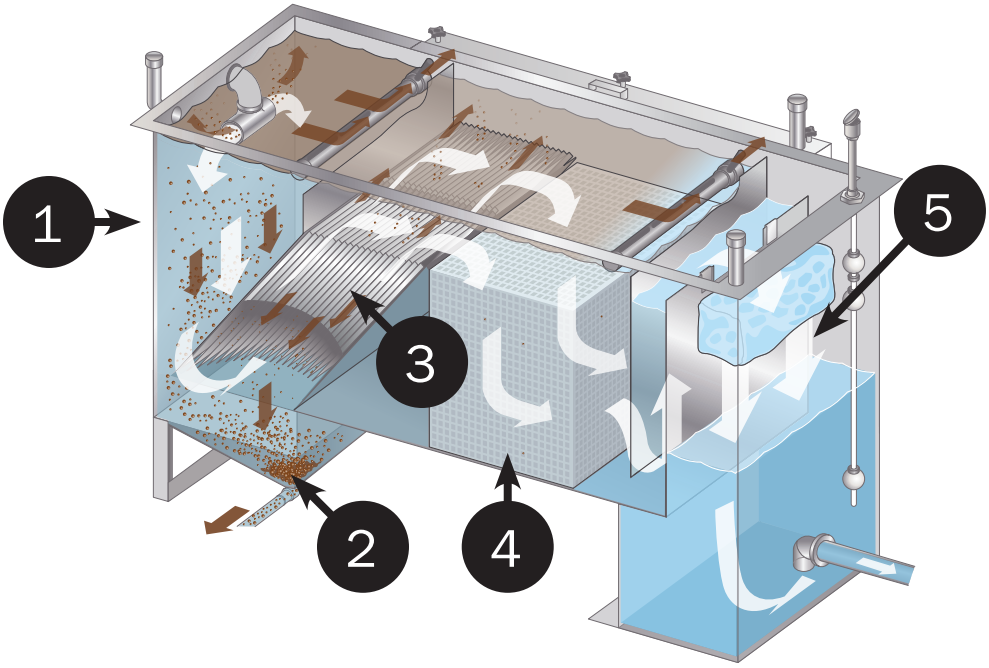
OIL & GAS APPLICATIONS

- Onshore and Offshore Drilling Operations
- Oil Refineries
- Flowback Water from Hydraulic Fracturing
- Produced Water
- Waste Oil Processing Facilities
- Frac Water

OTHER APPLICATIONS

- Washing Applications
- Industrial Applications

5 STAGES OF SEPARATION



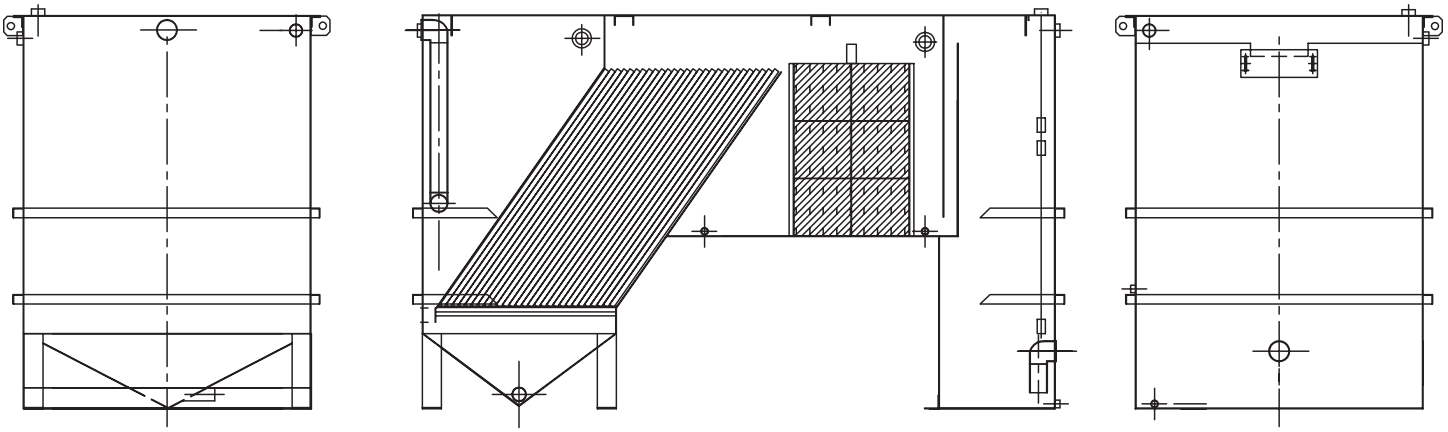
1. The **free oil** (150 micron in size or greater) is separated in the inlet quiescent zone. (Pipe skimmer provided to decant oil.)

2. The **settleable solids** will flow downward into the hopper section for removal.

3. The **suspended solids** and dispersed oil will flow upward through the inclined plates section, where most of the suspended solids will slide down the plates into the hopper (based on a design of .25 gpm per square foot of projected plate surface area).

4. The **remaining suspended solids** and **dispersed oil** will flow into the separation compartment where the coalescing plates will separate the oil 30 micron or greater to the surface for removal and the remaining suspended solids will be captured in the coalescing plates. The amount of solids in the plates will determine the frequency of plate cleaning. (Pipe skimmer for removal of separated oil.)

5. The flow of water will go over the overflow weir plate into the **clean water** compartment where absorption bags will prevent any carryover from being discharged. (Optional float switch shown.)



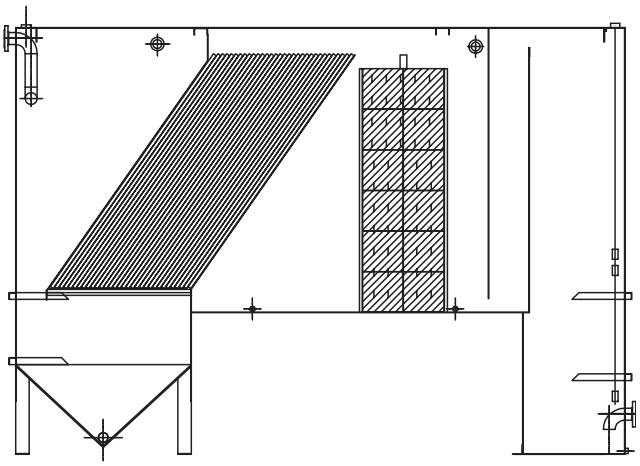
LEFT SIDE VIEW ELEVATION RIGHT SIDE VIEW

SPECIFICATIONS FOR SMALLER UNITS (SINGLE-HOPPER)

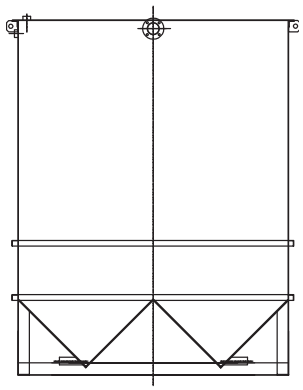
*Dimensions are approximate and may vary depending on your application.

Model	BPD (BARRELS PER DAY)	Inlet Outlet Dia.	Width	Height	Length	Clarifier Projected Plate (FT^2)	Separator Coalescing Media (FT^3)	Flow Rate (GPM)	Sludge Volume (GAL)	Capacity (GAL)
HQI-CS-10	342	2"	2' 4"	4' 10"	7' 0"	40	4	10	27	300
HQI-CS-20	685	2"	3' 4"	5' 10"	8' 0"	80	6	20	32	652
HQI-CS-30	1,028	2"	3' 4"	5' 10"	9' 2"	120	12	30	45	645
HQI-CS-50	1,714	3"	4' 4"	5' 10"	9' 8"	200	24	50	85	968
HQI-CS-75	2,571	3"	4' 4"	7' 10"	10' 6"	300	24	75	85	1,766
HQI-CS-100	3,428	4"	5' 4"	7' 10"	11' 0"	400	30	100	107	1,931
HQI-CS-150	5,142	6"	6' 6"	8' 4"	12' 0"	600	64	150	300	3,483

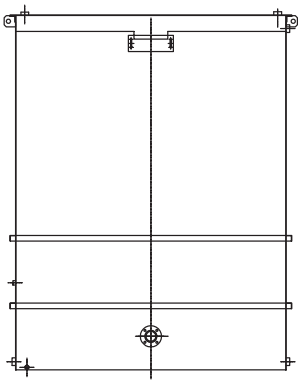
Oil Removal of 20 Micron Based on Flow Rates
Clarifier Projected Plate based on .25 gpm per sq. ft.
Design Temperature 40° F (5° C)



ELEVATION



LEFT SIDE VIEW



RIGHT SIDE VIEW

SPECIFICATIONS FOR LARGER UNITS (DOUBLE-HOPPER)

*Dimensions are approximate and may vary depending on your application.

Model	BPD (BARRELS PER DAY)	Inlet Outlet Dia.	Width (FT)	Height (FT)	Length (FT)	Clarifier Projected Plate (FT^2)	Separator Coalescing Media (FT^3)	Flow Rate (GPM)	Sludge Volume (GAL)	Capacity (GAL)
HQI-CS-200	6,857	6"	7' 6"	9' 6"	14' 0"	800	80	200	300	5,496
HQI-CS-250	8,571	8"	8' 6"	10' 6"	15' 0"	1,000	96	250	350	6,986
HQI-CS-300	10,285	8"	8' 6"	10' 6"	16' 0"	1,200	120	300	400	6,846
HQI-CS-350	12,000	8"	8' 6"	10' 6"	18' 0"	1,400	144	350	425	7,633
HQI-CS-400	13,714	8"	8' 6"	10' 6"	19' 0"	1,600	150	400	500	8,138
HQI-CS-450	15,428	8"	8' 6"	10' 6"	20' 0"	1,800	168	450	525	8,612
HQI-CS-500	17,142	8"	8' 6"	10' 6"	21' 4"	2,000	210	500	550	9,220
HQI-CS-550	18,857	8"	8' 6"	10' 6"	22' 6"	2,200	210	550	675	9,765
HQI-CS-600	20,570	10"	9' 6"	10' 6"	22' 0"	2,400	252	600	700	12,285
HQI-CS-700	24,000	10"	10' 6"	11' 6"	25' 0"	2,800	280	700	750	15,440
HQI-CS-800	27,428	10"	10' 6"	11' 6"	26' 0"	3,200	315	800	775	16,077
HQI-CS-900	30,850	12"	10' 6"	11' 6"	27' 0"	3,600	350	900	800	16,717

Oil Removal of 30 Micron Based on Flow Rates
Clarifier Projected Plate based on .25 gpm per sq. ft.
Design Temperature 40° F (5° C)

HYDRO QUIP

Whether an off-the-shelf unit or customized equipment, we'll help you determine the best solution for your application and site-specific needs.

TEL: 508-399-5771
FAX: 508-399-5352
108 Pond St, Seekonk, MA 02703
hqisales@hydroquipinc.com
www.hydroquipinc.com

ELLIS CORPORATION
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SECTION 11XXX

DISSOLVED AIR FLOTATION (DAF) CLARIFIER SPECIFICATIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnish complete, tested and operating, the equipment as shown on the Drawings and as specified herein.

B. Work Included in This Section:
   1. Dissolved Air Flotation with selected options.

1.02 SUBMITTALS

A. Shop Drawings: Upon agreement to terms, and receipt of a purchase order, Ellis Corporation will submit 2 sets of shop drawings (approval drawings) of the DAF clarifier and included options. Shop drawings to be reviewed by the ENGINEER (Or agent). Requests for modifications to the shop drawings will be addressed by Ellis Corporation and revised shop drawings will be resubmitted to the ENGINEER until satisfactory to the ENGINEER. Approved drawings will be signed and returned to Ellis Corporation.

B. Manuals: Ellis will furnish 2 sets of operation and maintenance manuals prior to or with delivery of the DAF separator.

1.03 QUALITY ASSURANCE

A. All equipment furnished under this section shall be tested prior to delivery. All welded joints shall be double welded and leak tested. All electrical components shall be shop tested for proper operation, rotation, and response.

1.04 WARRANTY

A. Ellis Corporation warrants the equipment manufactured by it to be free from defects in material and workmanship for a period of 1 (one) year from the date of shipment, provided the machine is operated normally and at its rated capacity. Modifications to the equipment or the use of repair parts not approved by the company will subject the warranty to cancellation.

1.05 The Dissolved Air Flotation System shall be designed, manufactured and warranted by Ellis Corporation, Industrial Water Division, Itasca, Ill.

Water Pollution Control Systems
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PART 2 - PRODUCTS

2.01 DISSOLVED AIR FLOTATION CLARIFIER

The Dissolved Air Flotation Clarifier is specifically designed to remove fats, oils, greases (FOG) and other suspended solids from a wastewater flow. Equipment is completely assembled and ready for installation on a concrete pad. Typical removal rates (with proper chemical treatment) are 95% and greater for both FOG's and suspended solids.

A. Separation Chamber
The separation chamber provides an excellent medium for solids flotation. Strategically placed baffles force float to the top of the unit, while driving sludge to the bottom and allowing clean water to carry through. The design allows for minimal velocities in the float region and the large float area in a compact design.

B. Skimmer Assembly
The all stainless steel surface skimmers are designed to skim the topmost portion of the accumulated float. The design of the skimmer is of the Ferris wheel type with the end of the skimming blade always pointing downward. The blade is mounted in a pivot to allow the skimmer to rotate during the skim and return cycle. This will prevent solids from accumulating on the blade surface. Skimmer driven by a variable speed drive.

C. Float Chamber
The float chamber is designed to isolate the solids from the waste stream and to provide storage capacity. The bottom of this chamber has sloped sides to form a "V" bottom to permit near complete pump out of the accumulated solids. The chamber also has provisions for sludge removal.

D. Solids chamber and auger
The lower portion of the solids chamber has sloped sides to form a "V" bottom chamber extending the length of the solids chamber. The "V" bottom chamber is equipped with a slowly rotating ribbon type screw auger to convey heavy gritty solids to a sludge discharge nozzle.

E. Effluent Chamber
An effluent chamber is provided to isolate clean water from the waste stream. Water flows into the effluent chamber via an adjustable weir. Positioning the 304 stainless steel adjustable weir sets the water level. This chamber has a discharge nozzle and provisions for recycle flow.

F. Dissolved Air Flotation pump
The dissolved air flotation pump is provided to dissolve the air into the water. An air control system is provided to meter air into the pump at specified rates. Air bubbles of roughly 30 micron will result through proper operation of the pump. Cast iron casing with 316 SS shaft and flooded suction.

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G. Materials of Construction
Tank is fabricated of heavy duty A-36 Carbon Steel Plate or 304 SS. Joints are double welded and leak tested. Exterior Structural members are constructed of A-36 carbon steel.

H. Finish – Stainless steel does not receive coatings
Interior: Surface prepared to SSPC-SP-10, near white metal blast and coated with multiple coats of coal tar epoxy, 14-16 dmt.

Exterior: Surfaces prepared to SSPC-SP-6, commercial blast and coated with a chromate free primer, rust color, 4 dmt. Top coat polyurethane enamel, 2 dmt. Finish color safety blue.

2.02 SLUDGE PUMPOUT SYSTEM – THIS IS OPTION "A"

A. An electrically operated progressive cavity positive displacement pump with intermittent timer. Automatic operation with manual override. System installed with PVC piping.

2.03 CHEMICAL PUMPS

A. Chemical pumps are supplied to inject chemicals into a preceding chemical mix tank to the DAF. The pumps are rated for 10 gph.

2.04 CONTROL PANEL

A. NEMA-4 Control panel with indicator light(s), switch(es), timer(s), motor starter(s), alarm light(s), alarm(s) with silence switch. Panel to control all components furnished by Ellis Corporation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment will be delivered to project site (terms as per contract). Installation Contractor is responsible for preparation of concrete pad (or other approved surface) and all anchor bolts. Holes for anchor bolts are as per shop drawings.

3.02 START-UP ASSISTANCE

A. Ellis Corporation will assist in the start-up of the system and instruction in the proper use of the equipment if required.

END OF SECTION

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APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 1: OPERATIONS, INSPECTION AND MAINTENANCE PLAN

ATTACHMENT II.1.C

WEEKLY INSPECTION FORM (TYPICAL)

ATTACHMENT II.1.C
Inspection Form (Typical)
OWL Landfill Services, LLC

Date: _____ **Print Name:** _____

Others: _____ **Signature:** _____

Inspection will be in accordance with NMOCD operational conditions.

Item	Satisfactory	Action Required
Entrance Sign		
Berms and outside pond levees		
Tank Labels		
Sumps		
Pond levels three-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 - Landfill - 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 - Stab. & Solid. - Liquid present?		(Monthly analysis required if yes)
Landfill Leachate Sump		
Vadose Zone Monitoring		
Pond Sludge Depth		

***Comments & Repairs:** _____

H_2S

READINGS ARE TO BE TAKEN 4 FT DOWNWIND FROM EVAPORATION PONDS

Evaporation Pond (readings in ppm):

POND
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 operator will monitor H_2S levels at the downwind of the Pond. If H_2S levels reach 20 ppm, the Facility will be closed and notification will be given to the following:

OWL 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: _____

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 1: OPERATIONS, INSPECTION AND MAINTENANCE PLAN

ATTACHMENT II.1.D

POND INTEGRITY/LEAK DETECTION INSPECTION FORM (TYPICAL)

ATTACHMENT II.1.D
Pond Integrity/Leak Detection Inspection Checklist (Typical)
OWL Landfill Services, LLC

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
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 1: OPERATIONS, INSPECTION AND MAINTENANCE PLAN

ATTACHMENT II.1.E

POTENTIAL GEOMEMBRANE LINER LEAKAGE

Attachment II.1.E
Potential Geomembrane Liner Leakage
OWL Landfill Services, LLC

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
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 1: OPERATIONS, INSPECTION AND MAINTENANCE PLAN

ATTACHMENT II.1.F

PAINT FILTER TEST PROTOCOL

USEPA 9095B

METHOD 9095B

PAINT FILTER LIQUIDS TEST

1.0 SCOPE AND APPLICATION

1.1 This method is used to determine the presence of free liquids in a representative sample of waste.

1.2 The method is used to determine compliance with 40 CFR 264.314 and 265.314.

2.0 SUMMARY OF METHOD

2.1 A predetermined amount of material is placed in a paint filter. If any portion of the material passes through and drops from the filter within the 5-min test period, the material is deemed to contain free liquids.

3.0 INTERFERENCES

3.1 Filter media were observed to separate from the filter cone on exposure to alkaline materials. This development causes no problem if the sample is not disturbed.

3.2 Temperature can affect the test results if the test is performed below the freezing point of any liquid in the sample. Tests must be performed above the freezing point and can, but are not required to, exceed room temperature of 25 ^{o}C.

4.0 APPARATUS AND MATERIALS

4.1 Conical paint filter -- Mesh number 60 +/- 5% (fine meshed size). Available at local paint stores such as Sherwin-Williams and Glidden.

4.2 Glass funnel -- If the paint filter, with the waste, cannot sustain its weight on the ring stand, then a fluted glass funnel or glass funnel with a mouth large enough to allow at least 1 in. of the filter mesh to protrude should be used to support the filter. The funnel should be fluted or have a large open mouth in order to support the paint filter yet not interfere with the movement, to the graduated cylinder, of the liquid that passes through the filter mesh.

4.3 Ring stand and ring, or tripod.

4.4 Graduated cylinder or beaker -- 100-mL.

5.0 REAGENTS

5.1 None.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

A 100-mL or 100-g representative sample is required for the test. If it is not possible to obtain a sample of 100 mL or 100 g that is sufficiently representative of the waste, the analyst may use larger size samples in multiples of 100 mL or 100 g, i.e., 200, 300, 400 mL or g. However, when larger samples are used, analysts shall divide the sample into 100-mL or 100-g portions and test each portion separately. If any portion contains free liquids, the entire sample is considered to have free liquids. If the sample is measured volumetrically, then it should lack major air spaces or voids.

7.0 PROCEDURE

7.1 Assemble test apparatus as shown in Figure 1.

7.2 Place sample in the filter. A funnel may be used to provide support for the paint filter. If the sample is of such light bulk density that it overflows the filter, then the sides of the filter can be extended upward by taping filter paper to the inside of the filter and above the mesh. Settling the sample into the paint filter may be facilitated by lightly tapping the side of the filter as it is being filled.

7.3 In order to assure uniformity and standardization of the test, material such as sorbent pads or pillows which do not conform to the shape of the paint filter should be cut into small pieces and poured into the filter. Sample size reduction may be accomplished by cutting the sorbent material with scissors, shears, a knife, or other such device so as to preserve as much of the original integrity of the sorbent fabric as possible. Sorbents enclosed in a fabric should be mixed with the resultant fabric pieces. The particles to be tested should be reduced smaller than 1 cm (i.e., should be capable of passing through a 9.5 mm (0.375 inch) standard sieve). Grinding sorbent materials should be avoided as this may destroy the integrity of the sorbent and produce many "fine particles" which would normally not be present.

7.4 For brittle materials larger than 1 cm that do not conform to the filter, light crushing to reduce oversize particles is acceptable if it is not practical to cut the material. Materials such as clay, silica gel, and some polymers may fall into this category.

7.5 Allow sample to drain for 5 min into the graduated cylinder.

7.6 If any portion of the test material collects in the graduated cylinder in the 5-min period, then the material is deemed to contain free liquids for purposes of 40 CFR 264.314 and 265.314.

8.0 QUALITY CONTROL

8.1 Duplicate samples should be analyzed on a routine basis.

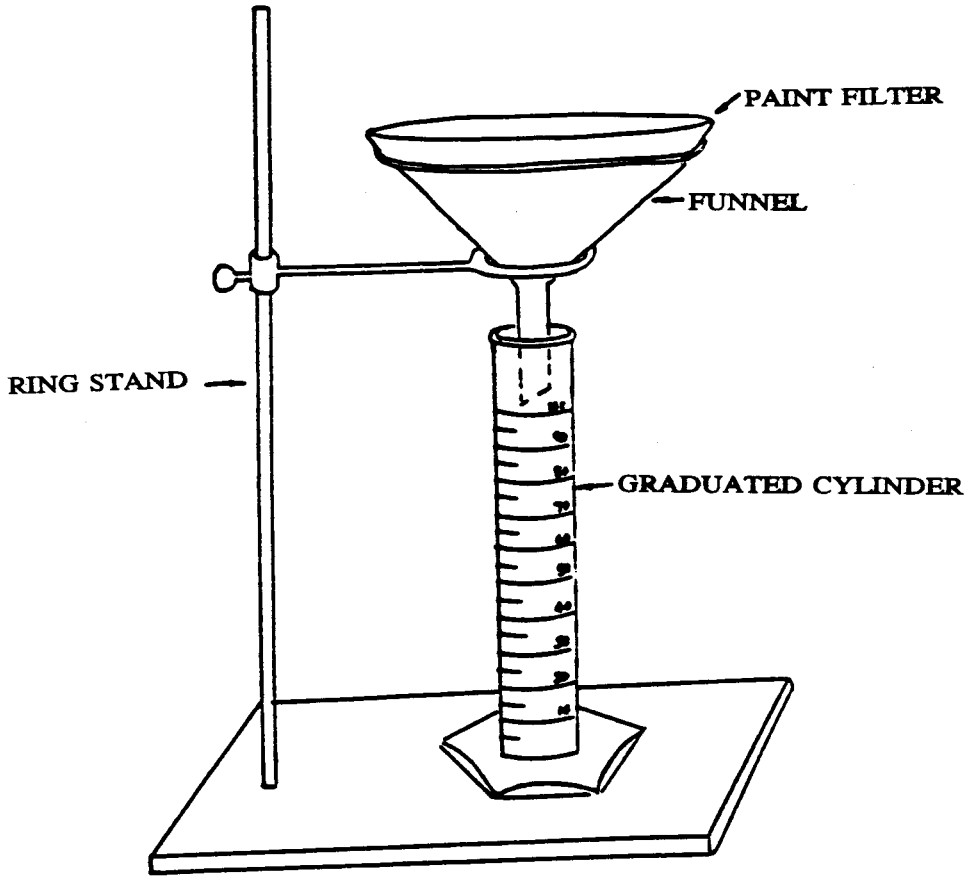
9.0 METHOD PERFORMANCE

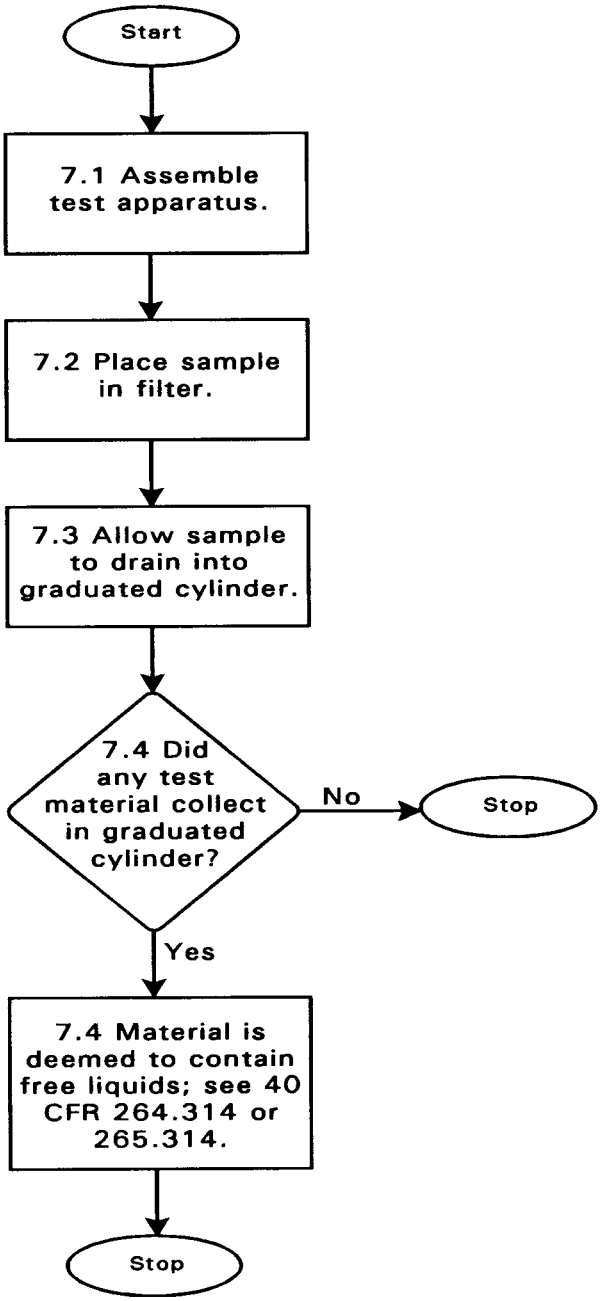
9.1 No data provided.

10.0 REFERENCES

10.1 None provided.

FIGURE 1
PAINT FILTER TEST APPARATUS




Start
7.1 Assemble test apparatus.
7.2 Place sample in filter.
7.3 Allow sample to drain into graduated cylinder.
7.4 Did any test material collect in graduated cylinder?
No
Stop
Yes
7.4 Material is deemed to contain free liquids; see 40 CFR 264.314 or 265.314.
Stop

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 1: OPERATIONS, INSPECTION AND MAINTENANCE PLAN

ATTACHMENT II.1.G

INTERMEDIATE COVER INSPECTION AND MAINTENANCE PLAN

ATTACHMENT II.1.G

INTERMEDIATE COVER INSPECTION AND MAINTENANCE PLAN

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LIST OF FIGURES

1.0 INTRODUCTION

In accordance with 19.15.36.14(7)(a-c) NMAC landfills are required to provide intermediate cover for areas that will not receive additional oil field waste for one month or more. In addition to being approved by the Oil Conservation Division, intermediate cover must be stabilized with vegetation, and inspected and maintained to prevent erosion and manage infiltration or leachate during the oil field waste deposition process. OWL Landfill Services, LLC (OWL) is requesting exception from the vegetation requirement. OWL proposes to maintain, as best possible, natural vegetation on the intermediate cover, but does not plan to seed intermediate cover that will be inactive less than 12 months. This Intermediate Cover Inspection and Maintenance Plan (the Plan) provides a protocol for regular monitoring and maintenance of intermediate cover at the OWL Environmental Solutions Surface Waste Management Facility Landfill.

2.0 INTERMEDIATE COVER

At OWL, intermediate landfill cover is proposed to consist of a soil cover a minimum of 6-inches thick. Intermediate cover will be placed over areas of the landfill that will not receive further oil field waste for one month or more, but have not reached final grades. Intermediate cover is graded to promote positive drainage and limit erosion and infiltration. The intermediate cover will be inspected and maintained until additional waste placement has been conducted or final cover is constructed. If additional waste placement is to occur, the upper layer of intermediate cover may be removed prior to additional waste placement. Inactive areas with intermediate cover will be stabilized via the routine inspection and maintenance program described below:

2.1 Intermediate Cover Inspection Program

Areas of the OWL Landfill that have intermediate cover installed will be inspected, at a minimum of once per month and also after significant ($\geq$ 0.5 inches) rain events. Inspections will be recorded on a form similar to that provided as **Figure II.1.G.1** (Intermediate Cover Inspection Form). The form will be used to record intermediate cover observations, and photo-documentation will supplement the record as necessary. The Intermediate Cover Inspection Forms will be maintained as part of the Facility Operating Record, and will elaborate on the following items, as applicable:

- Evidence of leachate
- Unusual odors
- Exposed waste

- Cracks greater than one inch in width and six inches in depth
- Surface water ponding
- Eroded or scoured soils
- Dead or stressed vegetation (if applicable)
- Vegetation growing taproots in areas not designated to accommodate them
- Vectors, such as flies and rodents
- Recordkeeping and reporting

Deficiencies identified during site inspections will be corrected within 30 days. Upon completion of the corrective action, appropriate documentation will be made on the Intermediate Cover Inspection Form and placed in the Facility Operating Record.

2.2 Intermediate Cover Maintenance Program

It is expected that routine site maintenance will be necessary to maintain intermediate cover. Intermediate cover is expected to require periodic maintenance such as soil enhancement/repair, and attention to naturally established vegetative cover.

2.2.2 Soil Repair

Intermediate cover repairs may be necessary due to ponding, surface water erosion or wind erosion. Ponding can result from differential settlement of the landfill contents, and erosion can be caused by runoff in areas without established vegetation or by repeated wind gusts. Areas where impacts are evident will be promptly repaired to maintain the integrity of the cover. Recently filled and covered areas will require the most maintenance since differential settlement decreases rapidly with time, and erosion is minimized as vegetation is established. Soil for repairs will be obtained from on-site sources. Repairs will be made on an as-needed basis.

2.2.3 Vegetation

Intermediate cover will not be seeded for vegetative growth; however, OWL will routinely attempt to maintain any naturally-established vegetative cover. Routine care includes, but is not limited to, the removal of undesirable plant species (e.g., taproots) and maintenance of native plant species as appropriate.

FIGURE II.1.G.1
Intermediate Cover Inspection Form
OWL Landfill Services, LLC

Date: _____ **Page** _____ of _____

Inspector(s): **Weather:** Temperature: _____ °F

_____ Skies: _____

_____ Precipitation: _____ inches (last 24 hours)

Intermediate Cover										
Location	**Odor**	**Leachate Seep**	**Exposed Waste**	**Cracks**	**Ponding**	**Erosion**	**Vegetation**		**Vectors**	**Sample**
							Stress	**Taproots**		

"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.

Field Notes: _____

Corrective Action Required: _____

Corrective Action Completed: _____ _____
Signature Date

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

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

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APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

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

1.0 INTRODUCTION

OWL Landfill Services, LLC (OWL) is proposing to permit, construct, and operate a "Surface Waste Management Facility" for oil field waste processing and disposal services. The proposed OWL Facility is subject to regulation under the New Mexico (NM) Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility has been designed in compliance with the requirements of 19.15.36 NMAC, and will be constructed, operated, and closed in compliance with a Surface Waste Management Facility Permit issued by the OCD.

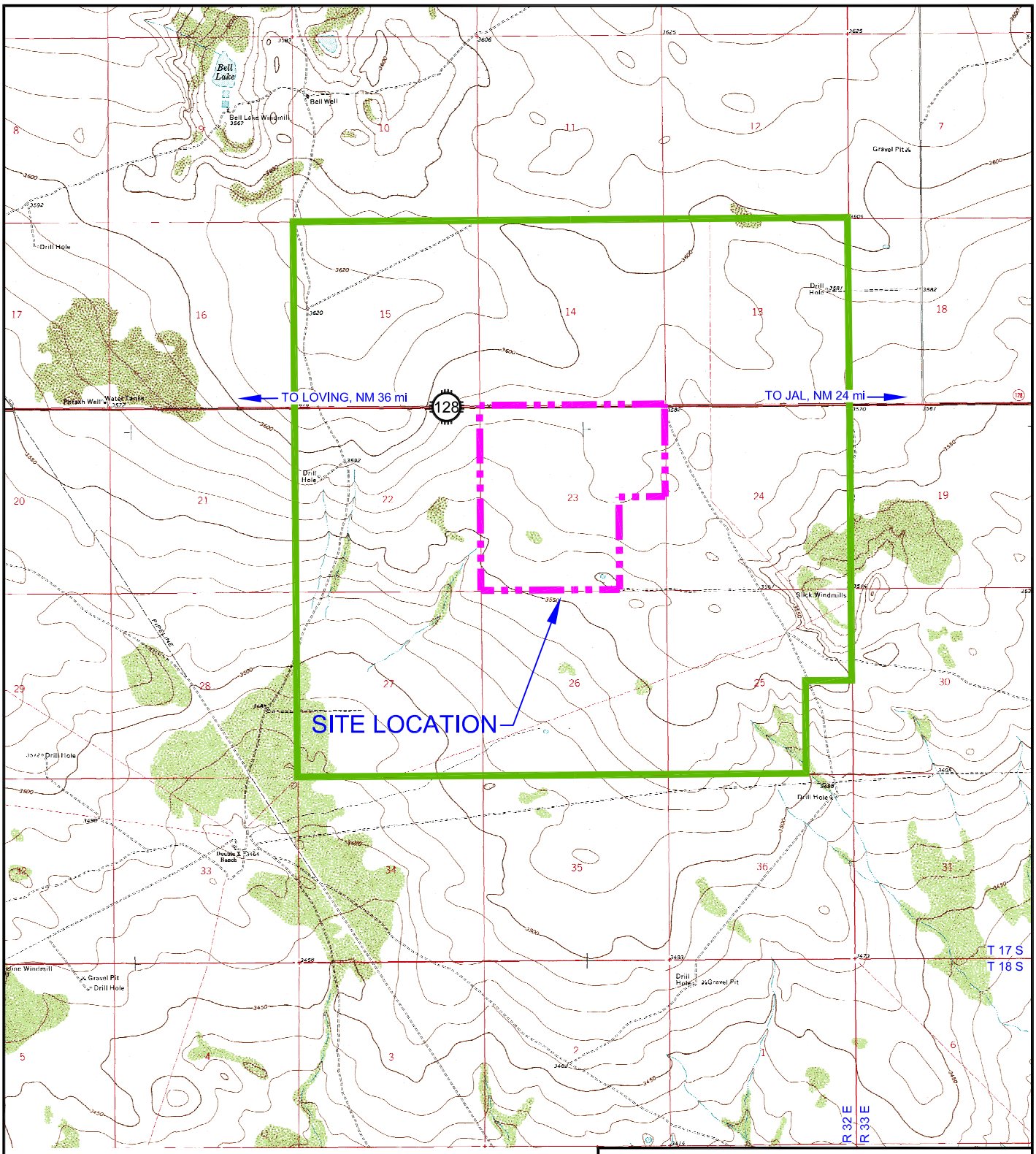
The OWL Facility is one of the first designed to the new more stringent standards that, for instance, mandate double liners and leak detection for land disposal. The new services that OWL will provide fill a necessary void in the market for technologies that exceed current OCD requirements.

1.1 Site Location

The OWL site is located approximately 22 miles northwest of Jal, adjacent to the south of NM 128 in Lea County, NM. The OWL site is comprised of a 560-acre ± tract of land located within a portion of Section 23, Township 24 South, Range 33 East, Lea County, NM (**Figure II.2.1**). Site access will be provided on the south side of NM 128. The coordinates for the approximate center of the OWL site are Latitude 32.203105577 and Longitude -103.543122319 (surface coordinates).

1.2 Facility Description

The OWL Surface Waste Management Facility will comprise approximately 500 acres of the 560-acre site, and will include two main components: an oil field waste Processing Area and an oil field waste Landfill, as well as related infrastructure. Oil field wastes are anticipated



LEGEND

SITE BOUNDARY

1 MILE OFFSET FROM SITE

NOTES:

1) SITE IS LOCATED WITHIN A PORTION OF SECTION 23, TOWNSHIP 24 SOUTH RANGE 23 EAST, LEA COUNTY, NEW MEXICO

2) MAP REFERENCE:
BELL LAKE, NM. 1973 USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP

NORTH

0 2000' 4000'

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\SITE LOCATION.dwg
Date/Time:Sep. 20, 2016-08:26:08 ; LAYOUT: A (P)

SITE LOCATION MAP

OWL LANDFILL SERVICES, LLC
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: 09/20/2016	CAD: SITE LOCATION.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.2.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

to be delivered to the OWL Facility from oil and gas exploration and production operations in southeastern NM and west Texas. The Permit Plans (**Attachment III.1.A**) identify the locations of the Processing Area and Landfill facilities.

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 OWL 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 mechanisms for OCD waste that may require special handling to meet regulatory requirements and/or to protect employee health and safety. 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.

3.0 OIL FIELD WASTE ACCEPTANCE PROGRAM

A decision to approve or disapprove incoming oil field waste for management at the OWL Facility will be clearly documented for each load received at the Facility, as delineated on **Table II.2.1**. Disposal operations at OWL will only be conducted when an attendant is on duty. OWL plans to conduct Facility operations 24 hours a day, 7 days a week. The Facility will be secured with barbed wire fencing, cattle guards, and locking gates to prevent any unauthorized access or disposal when an attendant is not on duty. The temporary parking area (**Permit Plans**) will be inspected for leakage, and vehicles will be required to have any valves or access ports secured and locked to prevent spillage or tampering. At a minimum, the following Waste Acceptance Protocol (**Table II.2.1**) requirements must be met prior to managing oil field waste at OWL.

TABLE II.2.1
Waste Acceptance Protocol
OWL Landfill Services, LLC

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.

The customer must provide OCD Form C-138, *Request for Approval to Accept Solid Waste* (**Attachment II.2.A**) to the Facility that issues the following certification that the waste is exempt oil field waste.

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 OWL 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 OCD Form C-138, the load of oil field waste will be rejected.

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

a) Monthly, the General Manager will provide the Facility personnel an updated list.
b) The OCD Form C-133 list will be maintained onsite in the OWL 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 OWL management personnel will be contacted if assistance is needed.

2. For Solid Waste:
In addition to providing OCD Form C-138, solid waste receipts will be subject to confirmation that the materials pass the Paint Filter Test (EPA 9095B). The protocol for this test is included as **Attachment II.2.C.** OWL may implement its own confirmatory solids testing program on a random basis, or to evaluate specific waste streams.

3. For Materials Delivered to be Stabilized and Solidified:
These materials will be stabilized and solidified utilizing the procedures outlined in **Volume II, Section 1** and confirmed that the materials pass the Paint Filter Test prior to transporting them to the landfill for disposal.

3.1 Prohibited Wastes

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 OWL. 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) 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 management.
   b) Every truck will stop at an inspection landing (similar to the one shown in **Figure II.2.2**) for evaluation by site personnel.
   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 position themselves upwind, and 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)

      Non-compliant wastes are not accepted and will be rejected and returned to the Hauler/Generator.

INSPECTION LANDING EXAMPLE

OWL LANDFILL SERVICES, LLC
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: 02/17/2016	CAD: INSPECTION.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.2.2
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\INSPECTION.dwg
Date/Time:Sep. 20, 2016-08:44:39

2. Presence of H_2S

OWL 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) OWL personnel will position themselves upwind 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) OWL 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 OWL Disposal Log (**Attachment II.3.D**).

In the event of an H_2S detection of 1 ppm or greater, the following procedures will also be implemented by OWL 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 OWL to treat the load on-site. Should the generator decline treatment, the load will be rejected and directed to leave the OWL Facility.
c) If the generator requests treatment, OWL 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 OWL Disposal Log (**Attachment II.3.D**).
f) OWL 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) OWL 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 template (**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. If required by OCD, the OWL General Manager will compile waste receipts information to be submitted to OCD.

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
- Document load refused on C-138 (**Attachment II.2.A**)

Wastes initially designated as “solids” destined for landfill disposal that do not pass the on-site confirmatory paint filter test will be so documented; and may be directed to the Stabilization/Solidification area.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

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

ATTACHMENT II.2.A

REQUEST FOR APPROVAL TO ACCEPT SOLID WASTE,

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
OWL LANDFILL SERVICES, LLC

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

ATTACHMENT II.2.B

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
OWL LANDFILL SERVICES, LLC

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

ATTACHMENT II.2.C

PAINT FILTER TEST PROTOCOL, USEPA METHOD 9095B

METHOD 9095B

PAINT FILTER LIQUIDS TEST

1.0 SCOPE AND APPLICATION

1.1 This method is used to determine the presence of free liquids in a representative sample of waste.

1.2 The method is used to determine compliance with 40 CFR 264.314 and 265.314.

2.0 SUMMARY OF METHOD

2.1 A predetermined amount of material is placed in a paint filter. If any portion of the material passes through and drops from the filter within the 5-min test period, the material is deemed to contain free liquids.

3.0 INTERFERENCES

3.1 Filter media were observed to separate from the filter cone on exposure to alkaline materials. This development causes no problem if the sample is not disturbed.

3.2 Temperature can affect the test results if the test is performed below the freezing point of any liquid in the sample. Tests must be performed above the freezing point and can, but are not required to, exceed room temperature of 25 ^{o}C.

4.0 APPARATUS AND MATERIALS

4.1 Conical paint filter -- Mesh number 60 +/- 5% (fine meshed size). Available at local paint stores such as Sherwin-Williams and Glidden.

4.2 Glass funnel -- If the paint filter, with the waste, cannot sustain its weight on the ring stand, then a fluted glass funnel or glass funnel with a mouth large enough to allow at least 1 in. of the filter mesh to protrude should be used to support the filter. The funnel should be fluted or have a large open mouth in order to support the paint filter yet not interfere with the movement, to the graduated cylinder, of the liquid that passes through the filter mesh.

4.3 Ring stand and ring, or tripod.

4.4 Graduated cylinder or beaker -- 100-mL.

5.0 REAGENTS

5.1 None.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

A 100-mL or 100-g representative sample is required for the test. If it is not possible to obtain a sample of 100 mL or 100 g that is sufficiently representative of the waste, the analyst may use larger size samples in multiples of 100 mL or 100 g, i.e., 200, 300, 400 mL or g. However, when larger samples are used, analysts shall divide the sample into 100-mL or 100-g portions and test each portion separately. If any portion contains free liquids, the entire sample is considered to have free liquids. If the sample is measured volumetrically, then it should lack major air spaces or voids.

7.0 PROCEDURE

7.1 Assemble test apparatus as shown in Figure 1.

7.2 Place sample in the filter. A funnel may be used to provide support for the paint filter. If the sample is of such light bulk density that it overflows the filter, then the sides of the filter can be extended upward by taping filter paper to the inside of the filter and above the mesh. Settling the sample into the paint filter may be facilitated by lightly tapping the side of the filter as it is being filled.

7.3 In order to assure uniformity and standardization of the test, material such as sorbent pads or pillows which do not conform to the shape of the paint filter should be cut into small pieces and poured into the filter. Sample size reduction may be accomplished by cutting the sorbent material with scissors, shears, a knife, or other such device so as to preserve as much of the original integrity of the sorbent fabric as possible. Sorbents enclosed in a fabric should be mixed with the resultant fabric pieces. The particles to be tested should be reduced smaller than 1 cm (i.e., should be capable of passing through a 9.5 mm (0.375 inch) standard sieve). Grinding sorbent materials should be avoided as this may destroy the integrity of the sorbent and produce many "fine particles" which would normally not be present.

7.4 For brittle materials larger than 1 cm that do not conform to the filter, light crushing to reduce oversize particles is acceptable if it is not practical to cut the material. Materials such as clay, silica gel, and some polymers may fall into this category.

7.5 Allow sample to drain for 5 min into the graduated cylinder.

7.6 If any portion of the test material collects in the graduated cylinder in the 5-min period, then the material is deemed to contain free liquids for purposes of 40 CFR 264.314 and 265.314.

8.0 QUALITY CONTROL

8.1 Duplicate samples should be analyzed on a routine basis.

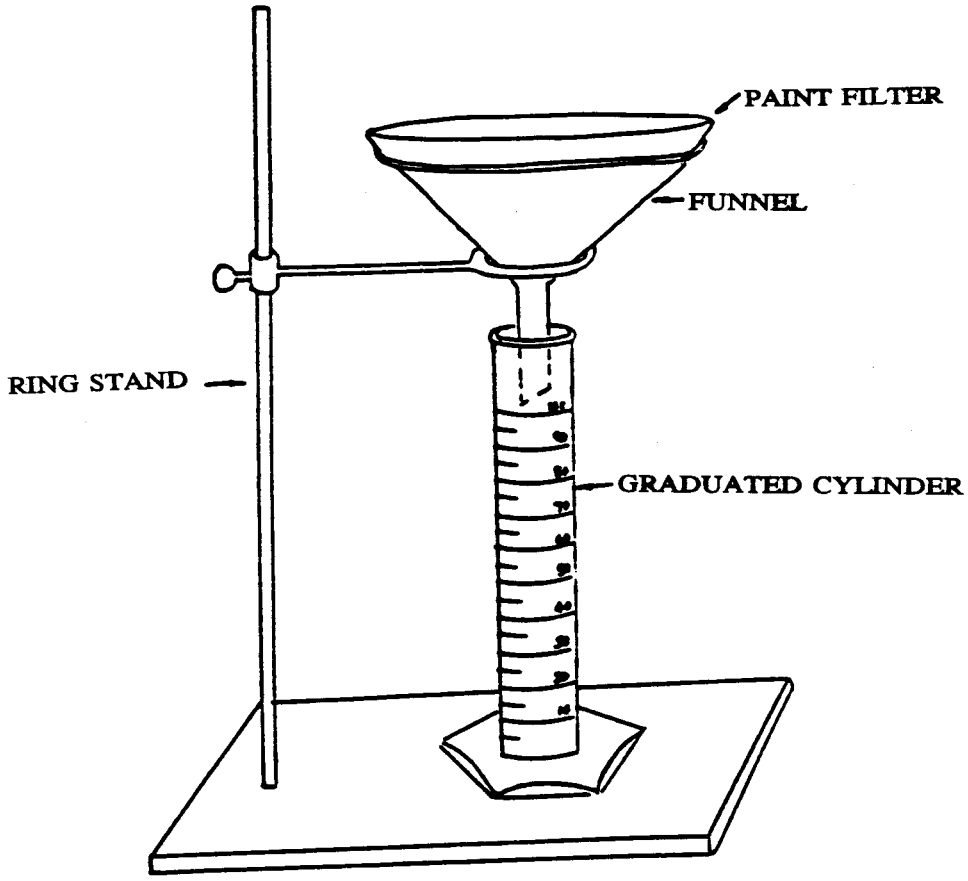
9.0 METHOD PERFORMANCE

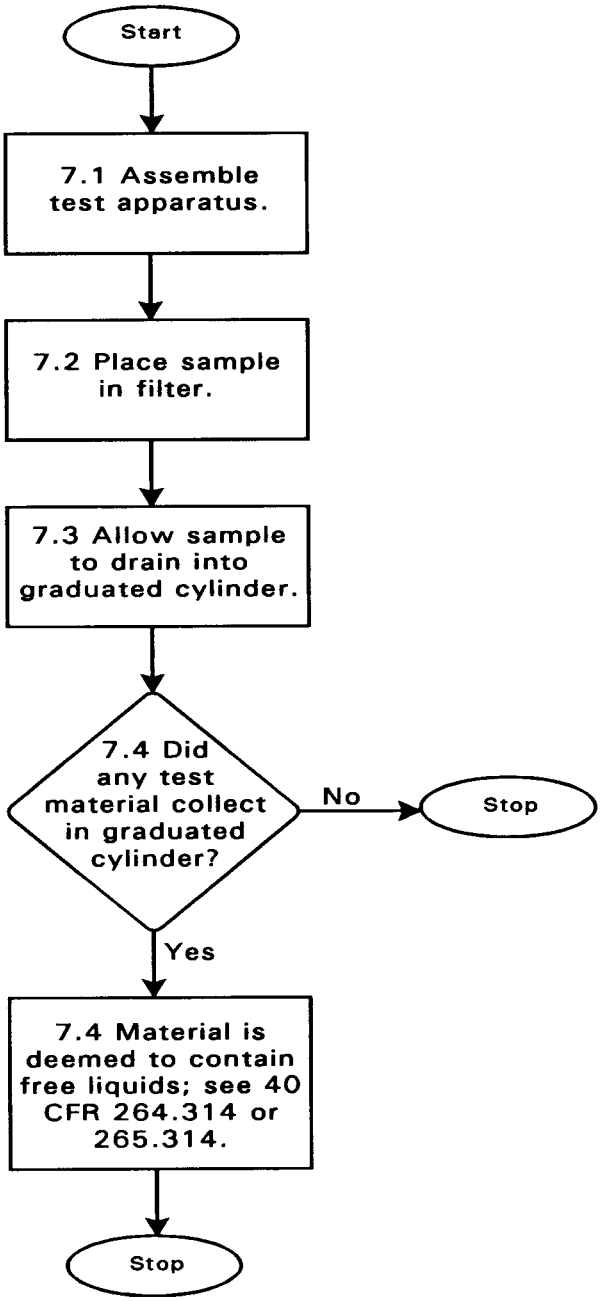
9.1 No data provided.

10.0 REFERENCES

10.1 None provided.

FIGURE 1
PAINT FILTER TEST APPARATUS




Start
7.1 Assemble test apparatus.
7.2 Place sample in filter.
7.3 Allow sample to drain into graduated cylinder.
7.4 Did any test material collect in graduated cylinder?
No
Stop
Yes
7.4 Material is deemed to contain free liquids; see 40 CFR 264.314 or 265.314.
Stop

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

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

ATTACHMENT II.2.D

DISPOSAL LOG BOOK (TYPICAL)

ATTACHMENT II.2.D
Disposal Log (Typical)
OWL Landfill Services, LLC

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
OWL LANDFILL SERVICES, LLC

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

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APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

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

1.0 INTRODUCTION

OWL Landfill Services, LLC (OWL) is proposing to permit, construct, and operate a "Surface Waste Management Facility" for oil field waste processing and disposal services. The proposed OWL Facility is subject to regulation under the New Mexico (NM) Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility has been designed in compliance with the requirements of 19.15.36 NMAC, and will be constructed, operated, and closed in compliance with a Surface Waste Management Facility Permit issued by the OCD.

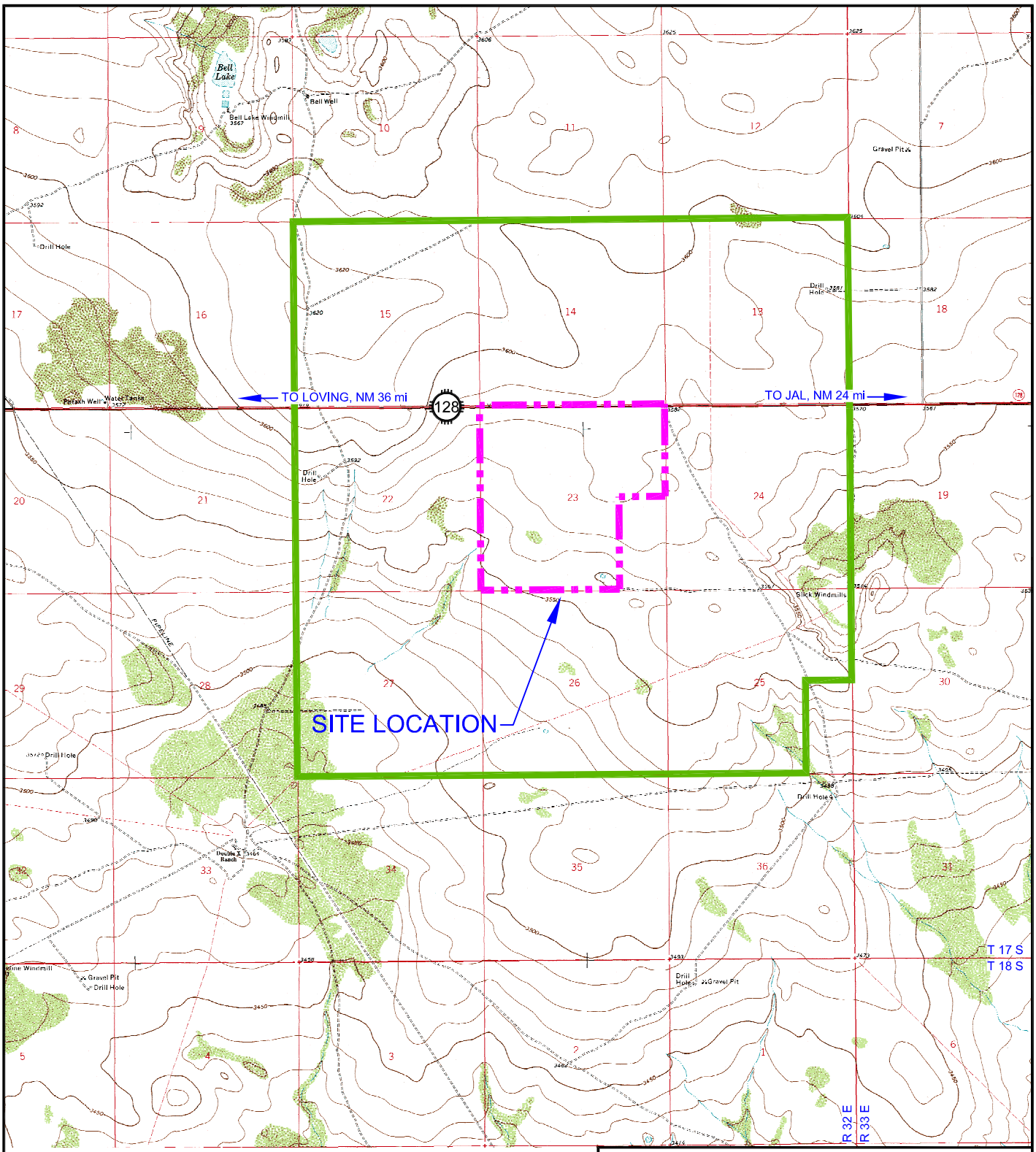
The OWL Facility is one of the first designed to the new more stringent standards that, for instance, mandate double liners and leak detection for land disposal. The new services that OWL will provide fill a necessary void in the market for technologies that exceed current OCD requirements.

1.1 Site Location

The OWL site is located approximately 22 miles northwest of Jal, adjacent to the south of NM 128 in Lea County, NM. The OWL site is comprised of a 560-acre ± tract of land located within a portion of Section 23, Township 24 South, Range 33 East, Lea County, NM (**Figure II.3.1**). Site access will be provided on the south side of NM 128. The coordinates for the approximate center of the OWL site are Latitude 32.203105577 and Longitude -103.543122319 (surface coordinates).

1.2 Facility Description

The OWL Surface Waste Management Facility will comprise approximately 500 acres of the 560-acre site, and will include two main components: an oil field waste Processing Area and an oil field waste Landfill, as well as related infrastructure. Oil field wastes are anticipated to be delivered to the OWL Facility from oil and gas exploration and production operations in



LEGEND

SITE BOUNDARY

1 MILE OFFSET FROM SITE

NOTES:

1) SITE IS LOCATED WITHIN A PORTION OF SECTION 23, TOWNSHIP 24 SOUTH RANGE 23 EAST, LEA COUNTY, NEW MEXICO

2) MAP REFERENCE:
BELL LAKE, NM. 1973 USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP

NORTH

0 2000' 4000'

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\SITE LOCATION.dwg
Date/Time:Sep. 20, 2016-08:09:43 ; LAYOUT: A (P)

SITE LOCATION MAP

OWL LANDFILL SERVICES, LLC
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: 09/20/2016	CAD: SITE LOCATION.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.3.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

southeastern NM and west Texas. The **Permit Plans** (**Attachment III.1.A**) identify the locations of the Processing Area and Landfill facilities. 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.

TABLE II.3.1
Proposed Facilities[1]
OWL Landfill Services, LLC

Description	No.
Oil field waste disposal landfill	1
Produced water load-out points	8
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 – bays	6

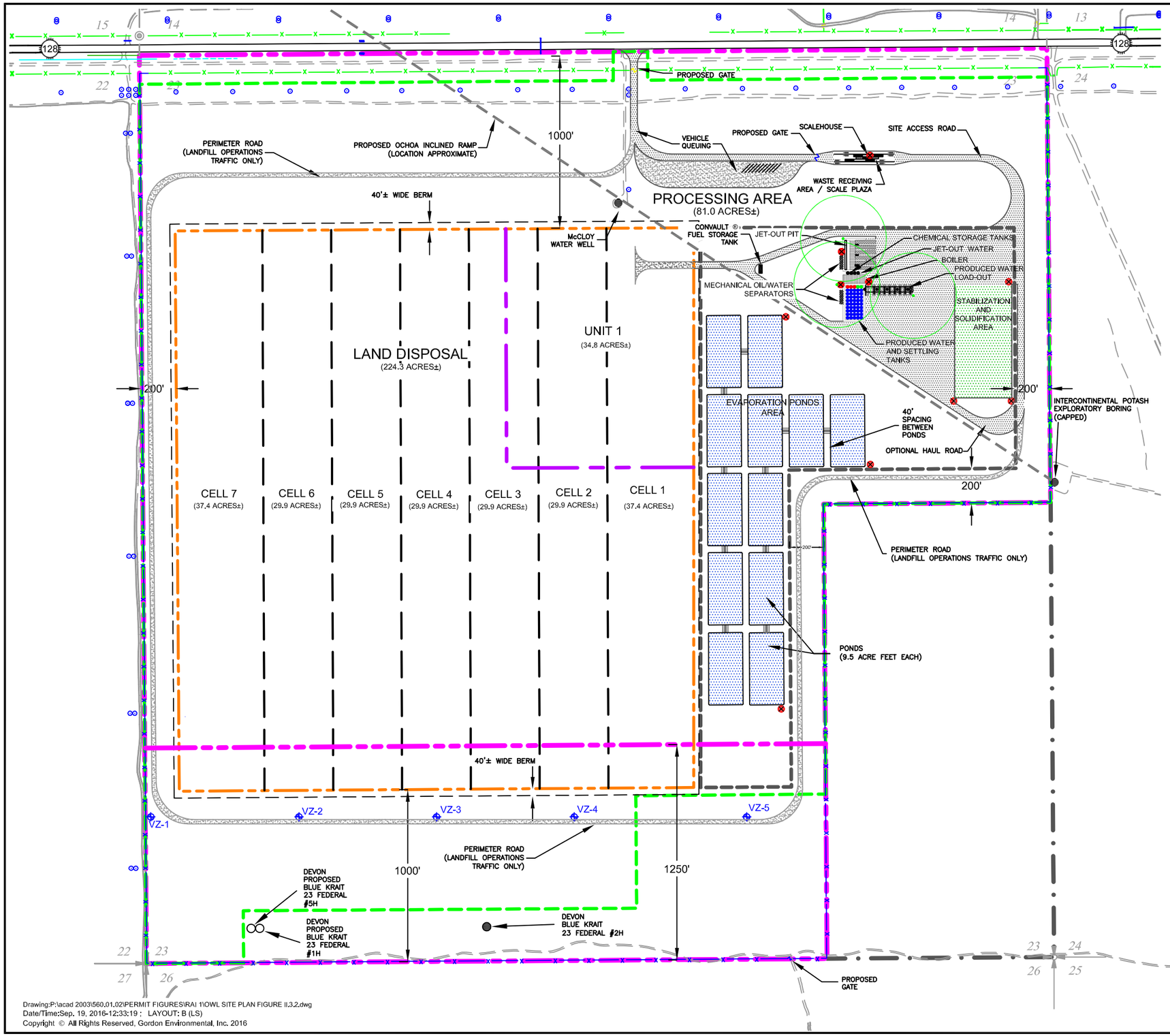
Note:
[1]Subject to change. The proposed facilities are based on projected waste types and volumes; therefore this list may be modified in response to changes in waste streams, technology innovations, etc.

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 OWL Facility, as well as the general public and nearby land users in conformance with 19.15.36.13.O NMAC.

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 at ≥1 part per million (ppm).



LEGEND

- SITE BOUNDARY (559.5 ACRES±)
- FACILITY BOUNDARY (500.0 ACRES)
- DISPOSAL AREA (224.3 ACRES±)
- PROCESSING AREA (81.0 ACRES±)
- UNIT 1 BOUNDARY (34.8 ACRES±)
- CELL BOUNDARY
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING FENCE
- EXISTING POWER POLE
- EXISTING CULVERT
- PROPOSED 3–STRAND BARBED WIRE FENCE
- PROPOSED UNPAVED ROAD (GRAVEL)
- PROPOSED UNPAVED ROAD (SOIL)
- VZ-2 PROPOSED VADOSE ZONE MONITORING WELL
- PPE AND EMERGENCY EQUIPMENT
- 250–FT. RADIUS OF EXPOSURE

NORTH

0 300' 600'

SITE PLAN

OWL LANDFILL SERVICES, LLC
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: 09/19/2016	CAD: SITE PLAN.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.3.2
APPROVED BY: IKG	gei@gordonenvironmental.com	

OWL 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, OWL will discuss notification, emergency response procedures, and evacuation plans. The H_2S monitoring program will be implemented during the active life of the Facility and following closure, as necessary.

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 OWL Facility, will mitigate against the potential release of H_2S in to the environment. The measures deployed by OWL 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
- Continual evaporation pond testing
- Employee training

TABLE II.3.2
Emergency Response Agencies and Contacts
OWL Landfill Services, LLC

Agency/Organization	Emergency Number
1. Fire	
Jal Fire Department	911 or (575) 395-2221
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
Jal Community Hospital 805 W. Kansas Avenue Jal, NM 88252	(575) 395-3400
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	
Environmental Emergency 24 hr. (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) 391-2983
8. Federal Emergency Response Contacts	
National Emergency Response Center (U.S. Coast Guard)	(800) 424-8802
Region VI Emergency Response Hotline (USEPA)	(214) 665-2200

TABLE II.3.3
H_2S Exposure Health Risk
OWL Landfill Services, LLC

H_2S EXPOSURE LEVEL[1]	HEALTH RISK
Low (0-10 ppm)	Eye, nose, and throat irritation; coughing, shortness of breath, fluid in the lungs
>1 ppm	Background level assumed acceptable for material acceptance. A reading above 1 ppm will require material remediation prior to acceptance.
Moderate (10-50 ppm)	Headache, dizziness, nausea and vomiting, coughing and breathing difficulty, loss of sense of smell
10 ppm	A reading of 10 ppm represents the NIOSH Recommended Exposure Limit (REL). This will represent the Sundance West "Alert Level". A sustained reading of 10 ppm or above will initiate an operational response and notifications.
20 ppm	A reading of 20 ppm represents the OSHA Permissible Exposure Limit (PEL). This will represent the Sundance West "Evacuation Level". A sustained reading of 20 ppm or above will initiate facility evacuation and notifications.
30 ppm	A reading of 30 ppm represents the API RP-55 exposure limit when all "public areas" within the radius of Exposure (ROE) must be notified.
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 incoming waste streams and evaporation ponds 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 and that the evaporation ponds are <10 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:

TABLE II.3.4
API Recommended Practice 55
OWL Landfill Services, LLC

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

19.15.36.8 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;

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 30 ppm (i.e., RP-55 limit) 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 (**Volume II.5**). The RP-55 limit of 30 ppm will result in a radius of exposure (ROE) of 250 ft from the point of release (assuming a release rate of 100 SCFH on Figure C-2 of RP-55). This ROE is depicted on **Figure II.3.2**, and there are no "public areas" within this ROE.

2.0 EMERGENCY COORDINATORS

OWL 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*
OWL Landfill Services, LLC

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 OWL 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 OWL 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

OWL 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 the OCD Form-C138 under "Source and Description of Waste" (**Attachment II.3.B**) and retained as part of the Facility Operating Record. OWL 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 1 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 OWL to treat the load on-site. Should the generator decline treatment, the load will be rejected and directed to leave the OWL Facility.
- If the generator requests treatment, OWL 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.

TABLE II.3.6
H_2S Treatment for Vehicles [1]
OWL Landfill Services, LLC

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*

- Treatment information and the final H_2S measurement will be recorded on the OCD Form-C138 under "Source and Description of Waste" (**Attachment II.3.B**).
- OWL personnel will contact the generator's Plant Manager or General Manager if assistance is needed.

3.2 Evaporation Pond Monitoring

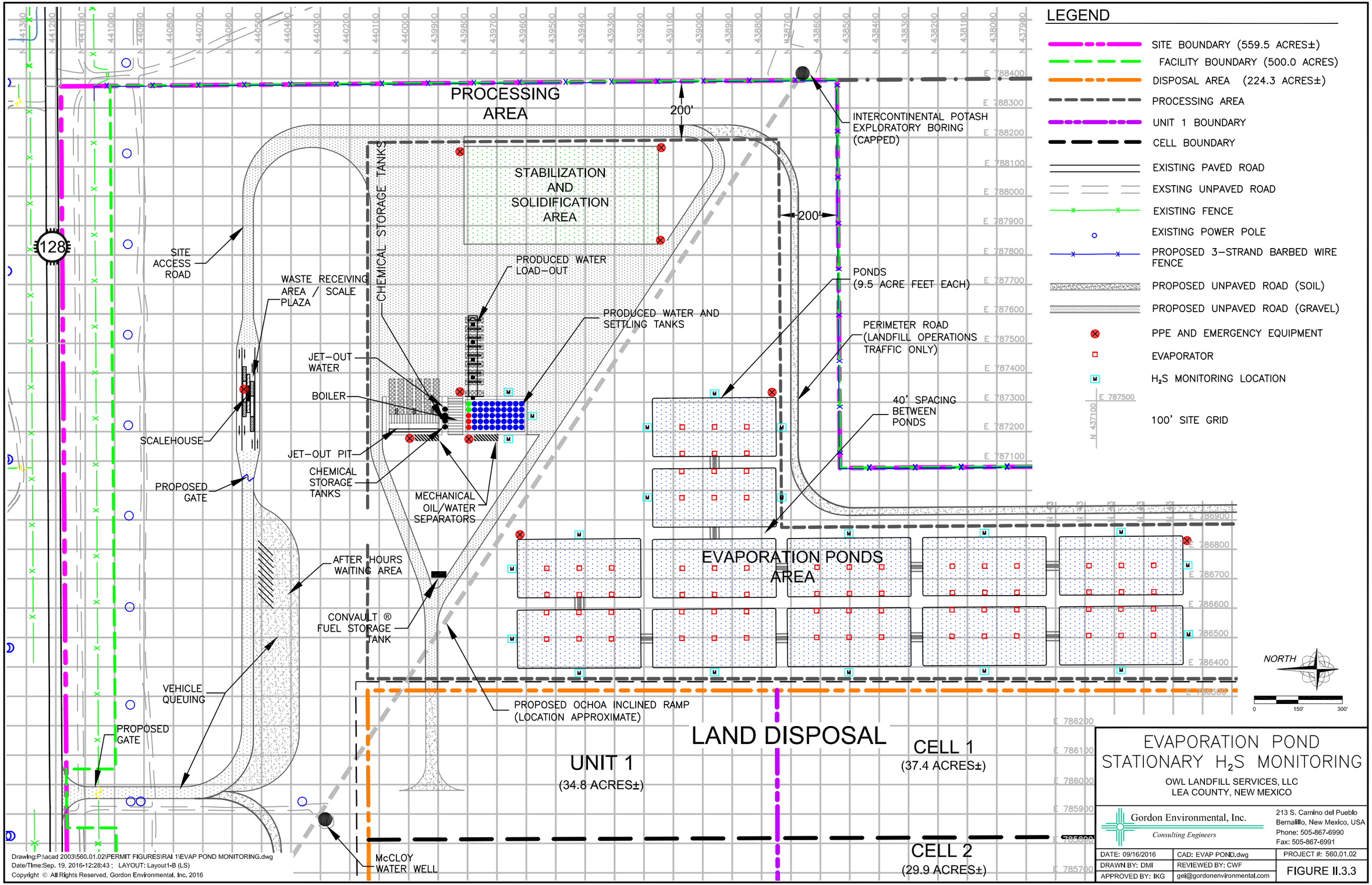
3.2.1 Stationary Monitors

Evaporation ponds will be monitored for the presence of H_2S by recording at continuous stations 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 OWL Daily Air and Water Inspection Form (**Attachment II.3.C**). The EC will be notified, and will implement the procedures outlined below if H_2S readings are $\geq$ 10 ppm. If H_2S readings are $\geq$ 20 ppm, the employee 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 10 ppm or greater are recorded:

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



EVAPORATION POND STATIONARY H_2S MONITORING

OWL LANDFILL SERVICES, LLC
LEA COUNTY, NEW MEXICO

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

DATE: 09/16/2016	CAD: EVAP POND.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: CWF	FIGURE II.3.3
APPROVED BY: IKG	gei@gordonenvironmental.com	

TABLE II.3.7
Implementation, Assessment, and Notification Procedures for H_2S
OWL Landfill Services, LLC

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 $H_2S \geq 10$ 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 $H_2S \geq 20$ 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, OWL 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.3.2**). In addition, medical authorities will be contacted if needed. OWL 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 of $\geq$10 ppm.
7. **RECORDKEEPING:** OWL will log and report to the OCD all incidences where an H_2S reading of $\geq$10 ppm is registered at the ponds (also see Section 6.0). Records will be maintained for at least 5 years at the OWL 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. OWL 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 or similar template (**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. Following 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:

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

The assessment provides the EC with critical data needed to determine whether an evacuation is necessary, whether emergency authorities should be contacted, and whether OWL 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 per 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 OWL and the rigorous operational safety protocols prescribed, 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 concerns that constitute a situation that could require evacuation include:

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

When conditions warrant immediate evacuation (e.g., H_2S ≥20 ppm), on-site persons (e.g., Facility personnel, haulers, visitors, vendors, etc.) will be directed to proceed immediately to the Facility Scalehouse for directions to evacuate through the main gates (**Figure II.3.4**), the primary evacuation route. OWL 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.3.8
Part 29: Release Notification
OWL Landfill Services, LLC

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.

TABLE II.3.9
Evacuation Procedures
OWL Landfill Services, LLC

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

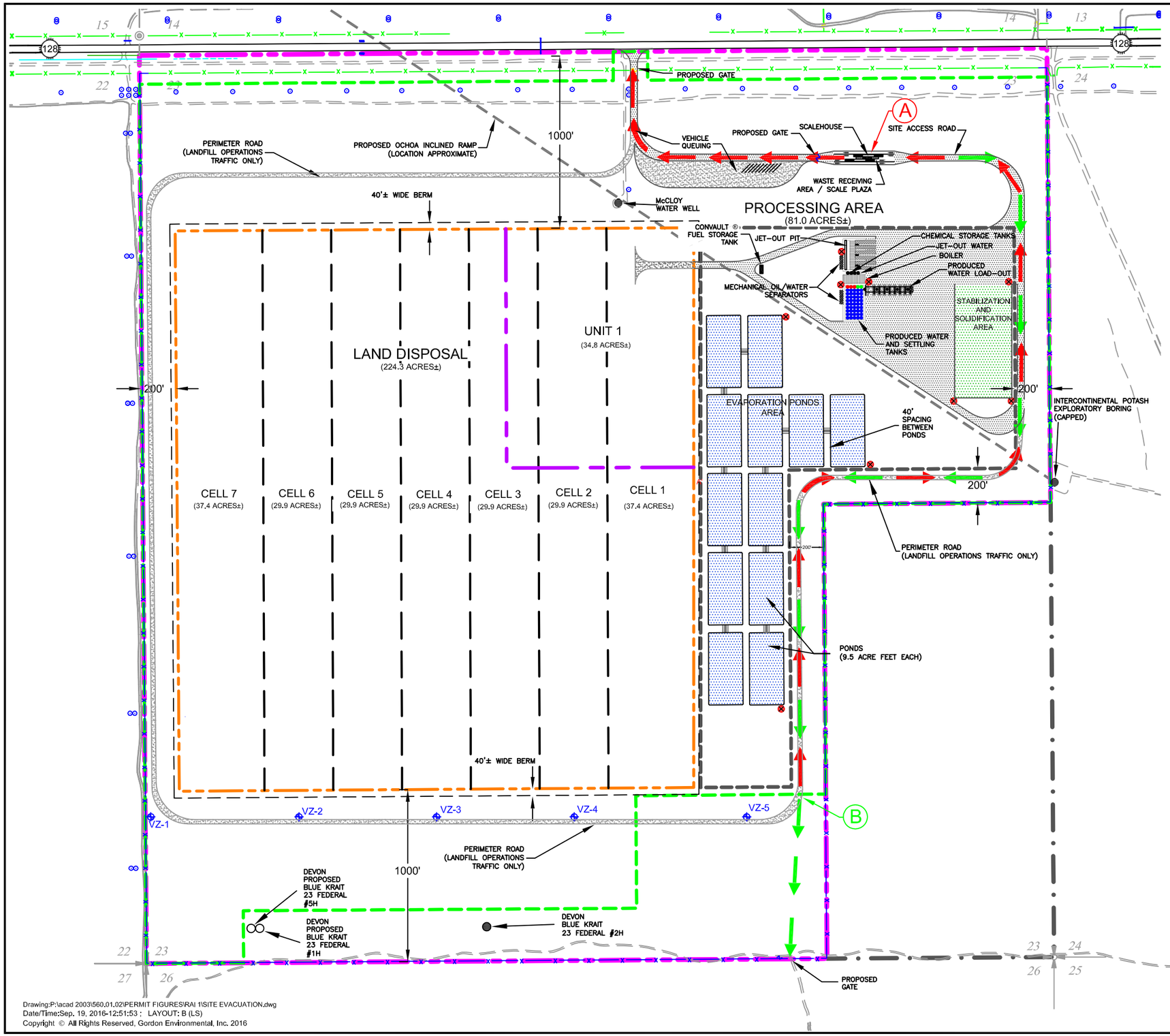
1. Facility personnel will be alerted directly or using the Facility telephone, cellular telephones, or radios.
2. Vehicles delivering waste will be diverted away from the location of the emergency and routed towards the Facility exit (**Figure II.3.2**).
3. All Facility operating equipment will be shut down.
4. Personnel will be directed to proceed to the Scalehouse, which will be the primary meeting location (**Figure II.3.4**). The EC will identify missing persons at that time.
5. If the emergency involves the 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.

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 prominently near on-site telephones and provided as handouts to OWL personnel, customers, response personnel, etc. 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 $\geq$10 ppm, notification will be provided to the New Mexico State Police, Lea County Sheriff, and OCD (also listed on **Table II.3.2**):



LEGEND

- SITE BOUNDARY (559.5 ACRES±)
- FACILITY BOUNDARY (500.0 ACRES)
- DISPOSAL AREA (224.3 ACRES±)
- PROCESSING AREA (81.0 ACRES±)
- UNIT 1 BOUNDARY (34.8 ACRES±)
- CELL BOUNDARY
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING FENCE
- EXISTING POWER POLE
- EXISTING CULVERT
- PROPOSED 3-STRAND BARBED WIRE FENCE
- PROPOSED UNPAVED ROAD (GRAVEL)
- PROPOSED UNPAVED ROAD (SOIL)
- VZ-2 PROPOSED VADOSE ZONE MONITORING WELL
- PPE AND EMERGENCY EQUIPMENT
- PRIMARY EVACUATION ROUTE
- SECONDARY EVACUATION ROUTE
- A PRIMARY MEETING LOCATION
- B SECONDARY MEETING LOCATION

NORTH

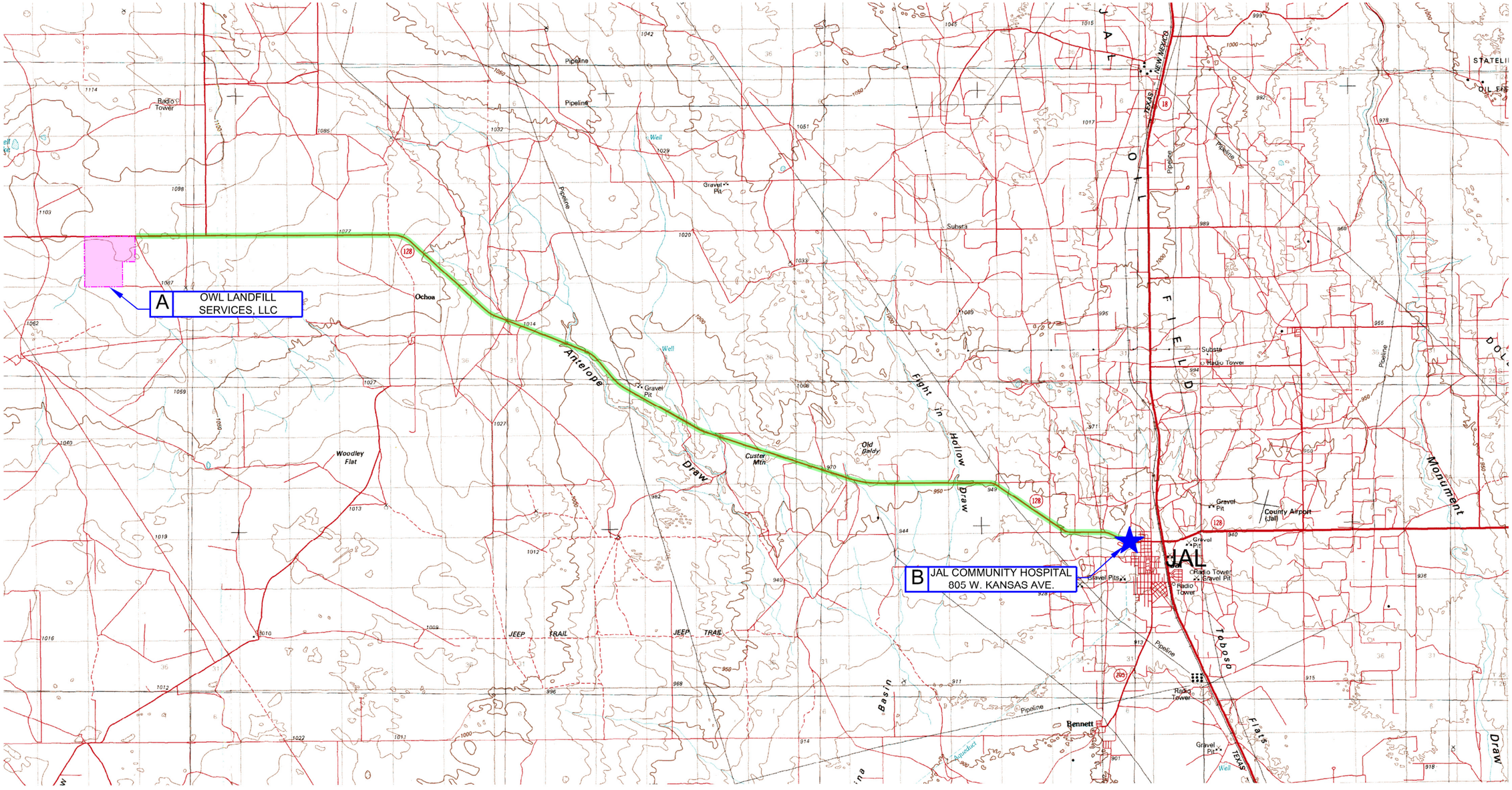
0 300' 600'

SITE EVACUATION MAP

OWL LANDFILL SERVICES, LLC
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: 09/16/2016	CAD: SITE EVACUATION.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.3.4
APPROVED BY: IKG	gei@gordonenvironmental.com	



A: OWL LANDFILL SERVICES, LLC. NM 529

1. Head EAST on NM-128 toward JAL 23.17 mi
2. Arrive 805 W. KANSAS AVE. (PH 575-395-3400) 0.0 mi

B: JAL COMMUNITY HOSPITAL 805 WEST KANSAS AVE. JAL, NM 88252

Note: A to B Travel Estimates: 25 minutes / 23.17 miles

MAP REFERENCE:
USGS JAL QUADRANGLE
NEW MEXICO–TEXAS 1:100,000 SCALE SERIES 1978

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\HOSPITAL LOCATION.dwg
Date/Time:Sep. 20, 2016-09:27:39 ; LAYOUT: B (LS)

HOSPITAL LOCATION MAP

OWL LANDFILL SERVICES, LLC
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: 09/20/2016	CAD: HOSPITAL LOCATION.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.3.5
APPROVED BY: IKG	gei@gordonenvironmental.com	

- 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) 391-2983

OWL will also notify Phoenix Environmental, a third-party response specialist (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**) by the EC. 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 Emergency Response Hotline (USEPA): (214) 665-2200

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

Recordkeeping will be recorded as detailed in Section 6.0, and Plan Amendments accomplished in accordance with Section 8.0.

5.0 EMERGENCY EQUIPMENT

The following sections describe emergency equipment at OWL 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]
OWL Landfill Services, LLC

Equipment Description	Quantity	Location	Use(s)
10 lb ABC rated fire extinguisher (1 min)	2	Scalehouse	Firefighting
10 lb ABC rated fire extinguisher (1 min)	1 per vehicle	Trucks	Firefighting
10 lb ABC rated fire extinguisher (1 min)	1 per vehicle	Heavy Equipment	Firefighting
20 lb ABC rated fire extinguisher (2 min)	1	Oil Process Tanks	Firefighting
20 lb ABC rated fire extinguisher (2 min)	1	Oil Sales Tanks	Firefighting
20 lb ABC rated fire extinguisher (2 min)	1	Produced Water Receiving Tanks	Firefighting
20 lb ABC rated fire extinguisher (2 min)	1	Diesel Storage Tank	Firefighting
Loader (5 cy)	1	Facility	Berm Repair & Smothering Fires
Oil Booms (200 ft)	4	NE Corner of Pond	Oil Containment
Self-contained Breathing Apparatus	1 per employee	Scalehouse	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	Scalehouse	Contain spillage, putting out fires
First Aid Kit	1	Scalehouse	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 Scalehouse	Communications
Cell Phones (Unlimited Range)	min. 3	Facility Manager Facility Operator Facility Operator	Communications
Office Phone	2	Scalehouse	Communications
Mobile pressure washer	1	Mobile	Decontaminating equipment

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

5.1 Internal Communications

Communications at OWL will be accomplished via cellular telephones, land lines, two-way radios, etc. 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 listed on **Table II.3.10.**

5.2 External Communications

The land-line telephones and cell phones located at OWL 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 (hard-line) telephone. Emergency phone numbers will be posted in the Facility Scalehouse and provided to employees and key customers 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 OWL 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 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 an 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 OWL, 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.3.2** 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, contingency procedures, etc.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

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

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.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

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

ATTACHMENT II.3.B

REQUEST FOR APPROVAL TO ACCEPT SOLID WASTE

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
OWL LANDFILL SERVICES, LLC

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

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)
OWL Landfill Services, LLC

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							

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

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

ATTACHMENT II.3.D

INCIDENT REPORT FORM (TYPICAL)

INCIDENT REPORT FORM
OWL Landfill Services, LLC

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
OWL Landfill Services, LLC

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
OWL LANDFILL SERVICES, LLC

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
OWL LANDFILL SERVICES, LLC

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

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OWL LANDFILL SERVICES, LLC

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LIST OF ATTACHMENTS

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

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

1.0 INTRODUCTION

OWL Landfill Services, LLC (OWL) is proposing to permit, construct, and operate a "Surface Waste Management Facility" for oil field waste processing and disposal services. The proposed OWL Facility is subject to regulation under the New Mexico (NM) Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility has been designed in compliance with the requirements of 19.15.36 NMAC, and will be constructed, operated, and closed in compliance with a Surface Waste Management Facility Permit issued by the OCD.

The OWL Facility is one of the first designed to the new more stringent standards that, for instance, mandate double liners and leak detection for land disposal. The new services that OWL will provide fill a necessary void in the market for technologies that exceed current OCD requirements.

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 OWL 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 (i.e., 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**, OWL Development Sequence, provides an outline of the projected phased development, including an implementation schedule for the installation of waste processing and disposal

TABLE II.4.1
OWL Development Sequence[1]
OWL Landfill Services, LLC

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 4,000 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 recovered from the Produced Water Tanks will also be pumped 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 4,000 bbl per day of liquid	The additional oil recovered from the expanded Produced Water Processing Operation process, anticipated to be 6 bbl per day (for a total of 12 bbls 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 OWL site development sequence is subject to change. Different combinations of these improvements may be constructed at any time. OCD will be notified in advance of construction.*

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

[3] *bbl = barrels of oil*

activities at the OWL 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 OWL to address changes in site or operating conditions; and submitted and approved by OCD 30 days prior to implementation of the proposed change. This Plan may also be amended at the request of OCD per 19.15.36.18.A(5) NMAC.

1.2 Site Location

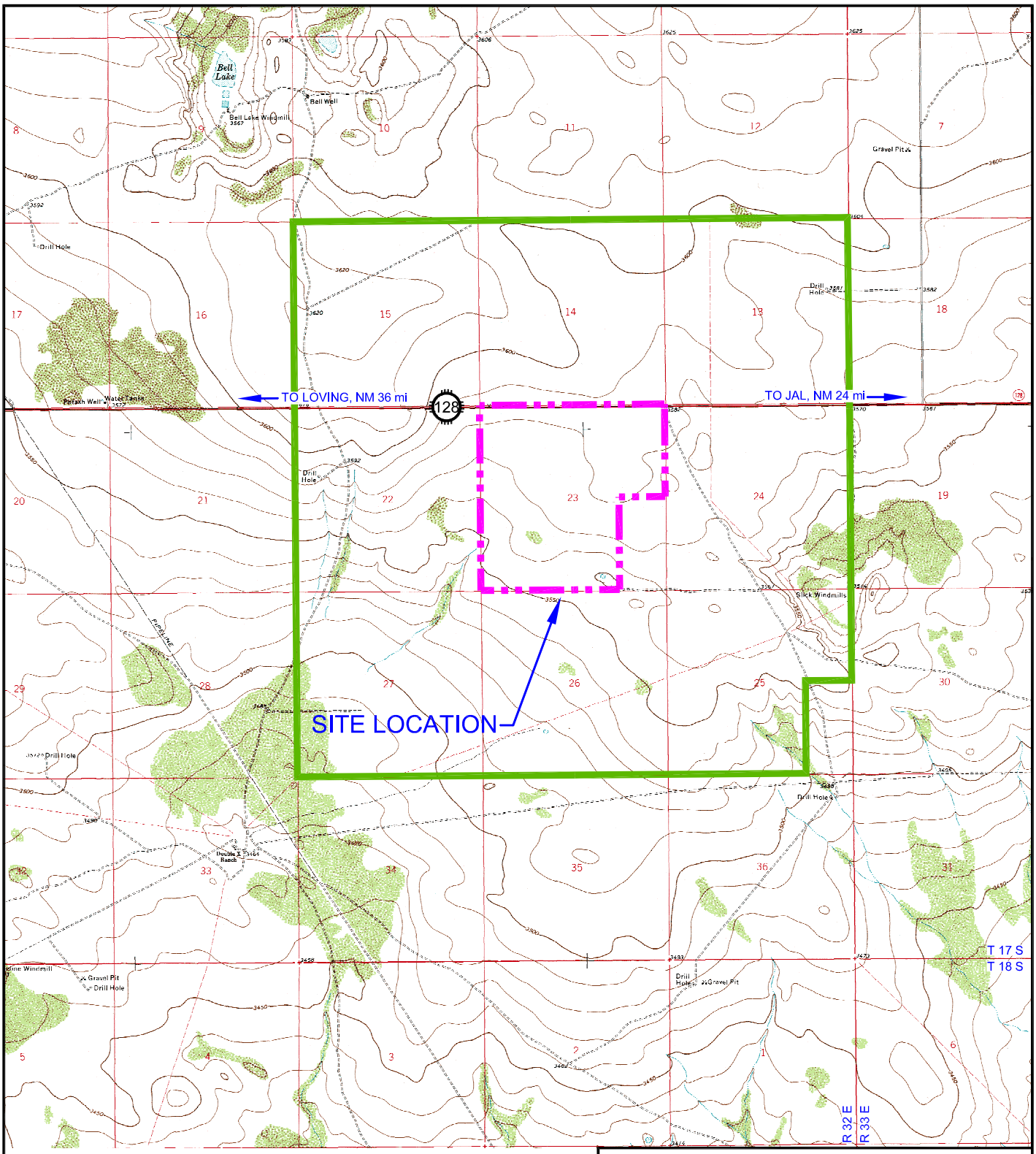
The OWL site is located approximately 22 miles northwest of Jal, adjacent to the south of NM 128 in Lea County, NM. The OWL site is comprised of a 560-acre ± tract of land located within a portion of Section 23, Township 24 South, Range 33 East, Lea County, NM (**Figure II.4.1**). Site access will be provided on the south side of NM 128. The surface coordinates for the approximate center of the OWL site are Latitude 32.203105577 and Longitude -103.543122319.

1.3 Facility Description

The OWL Surface Waste Management Facility will comprise approximately 500 acres of the 560-acre site, and will include two main components: an oil field waste Processing Area and an oil field waste Landfill, as well as related infrastructure. Oil field wastes are anticipated to be delivered to the OWL Facility from oil and gas exploration and production operations in southeastern NM and west Texas. The **Permit Plans** (**Attachment III.1.A**) identify the locations of the Processing Area and Landfill facilities.

2.0 CLOSURE PLAN

Surface waste management facility closure may be initiated by the Operator, or by the Division in accordance with 19.15.36.18.C NMAC. Closure of the OWL facility is required to be conducted per the terms of its Permit and this Plan.



LEGEND

SITE BOUNDARY

1 MILE OFFSET FROM SITE

NOTES:

1) SITE IS LOCATED WITHIN A PORTION OF SECTION 23, TOWNSHIP 24 SOUTH RANGE 23 EAST, LEA COUNTY, NEW MEXICO

2) MAP REFERENCE:
BELL LAKE, NM. 1973 USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP

NORTH

0 2000' 4000'

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\SITE LOCATION.dwg
Date/Time:Sep. 20, 2016-08:24:02 ; LAYOUT: A (P)

SITE LOCATION MAP

OWL LANDFILL SERVICES, LLC
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: 09/20/2016	CAD: SITE LOCATION.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.4.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

2.1 Construction Schedule

OWL will notify OCD's Environmental Bureau at least 60 days prior to cessation of permanent operations at the 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 OWL will coordinate the required site inspection by OCD. During this period, OWL and OCD will additionally review and modify parts of this 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 OWL of modifications or additions to this Plan, OWL will commence the following closure activities at the Facility provided the Director has not extended, for good cause, the OCD's response to the closure notification, as summarized on **Table II.4.2**.

TABLE II.4.2
Closure Procedures
OWL Landfill Services, LLC

- 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 processed and pumped or transported to the evaporation ponds. Once produced water is placed into the ponds, and free floating crude oil is removed and delivered to the Treatment Plant, evaporation will be conducted with or without the aid of a mechanical evaporation system. OWL may introduce soils when sufficient

evaporation has taken place to expedite solidification. Once solidification has been completed and the waste has been tested (paint filter), the material will be encapsulated at the solid waste disposal area (OWL Landfill). Although highly unlikely, should the OWL Landfill not be in operation at the time of closure, 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., passing the paint filter test). Testing of the sludge will be performed prior to removal and disposal of the material in the OWL Landfill. Although highly unlikely, should the OWL 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 as self-generated exempt waste in conformance with current operating standards.

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. OWL proposes to cut the HDPE liner material and geocomposite into manageable pieces and dispose of the material in the OWL Landfill; or to transport the material to a New Mexico Environment Department Solid Waste Bureau approved recycling or disposal facility upon approval from OCD.

2.4 Tank Removal

Upon closure, tanks, piping and equipment will be emptied and cleaned. OWL will test accordingly and dispose of the residual exempt oil field waste removed from the tanks and deposit it in the solidification waste disposal area. If the OWL Landfill is not in operation at time of closure, remaining solids will be removed and disposed of in an OCD-approved surface waste management facility capable of managing the exempt waste stream. OWL 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-Out Facility

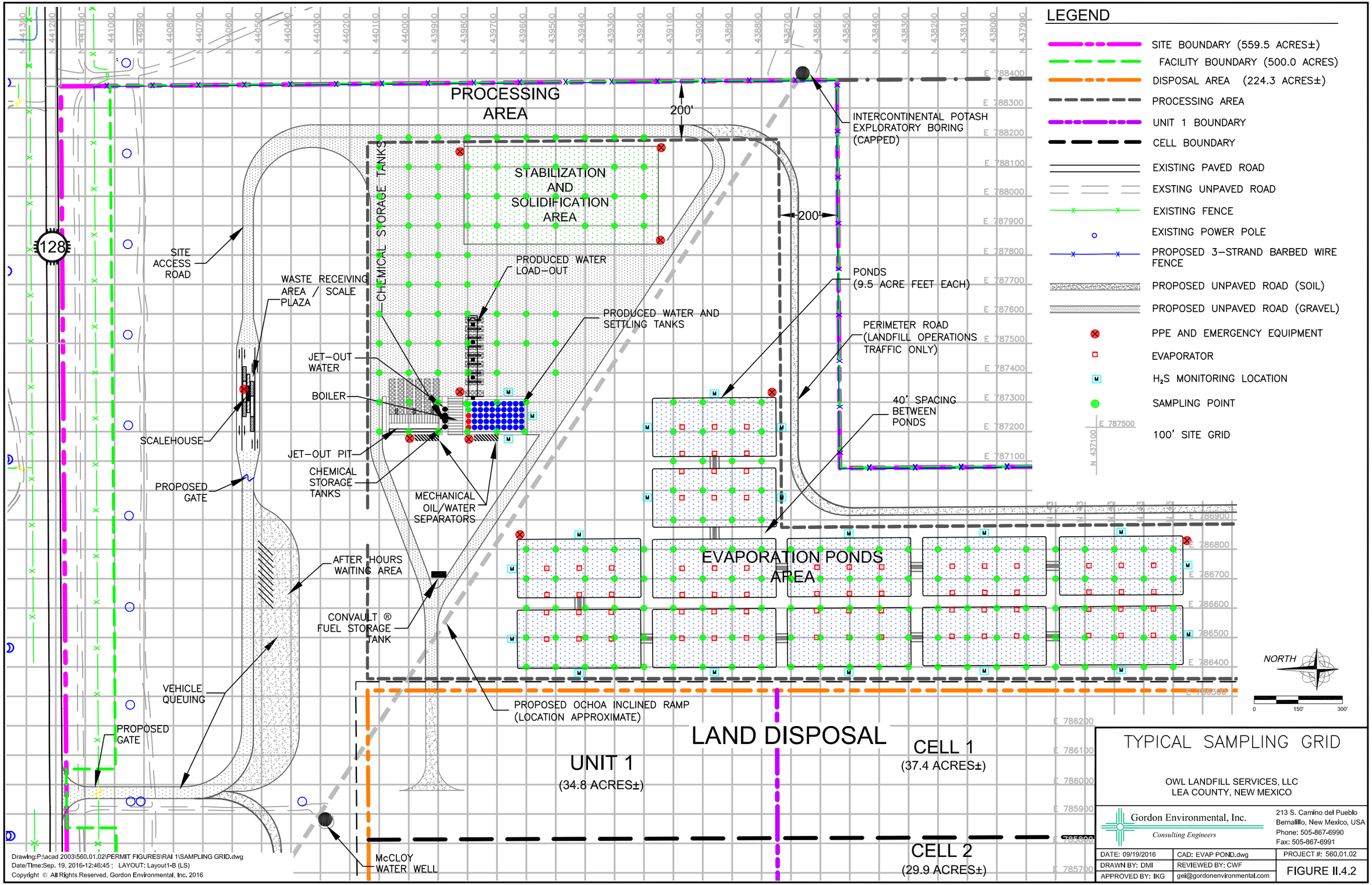
Closure of the Jet-Out Facility will consist of dismantling the above-grade installations for recycling (of clean elements) or on-site disposal. The tanks will be cleaned for reuse or recycled as scrap metal. The liner and gravel from the leak detection zone will be exhumed and disposed of on-site as described in Section 2.3. If the OWL 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 following OCD procedures.

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 OWL 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 following OCD disposal protocols.

2.7 Site Sampling

Once Processing Area tanks, equipment, and liners have been removed, but prior to backfilling the pond area 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* (per 19.15.36.18.D(1)(b) and 19.15.36.18.E(4) NMAC). A typical sampling grid is provided as **Figure II.4.2** (at 5 tests/acres), which illustrates the proposed sampling grid for the OWL Processing Area to document proper closure. Soil samples will be collected at select locations in the areas used for shipping and receiving, treatment and storage areas, and the evaporation ponds area. The soil samples will be collected 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. Pond and pit samples will be evaluated for the following constituents:



TYPICAL SAMPLING GRID

OWL LANDFILL SERVICES, LLC
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: 09/19/2016	CAD: EVAP POND.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: CWF	FIGURE II.4.2
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\RAI 1\SAMPLING GRID.dwg
Date/Time:Sep. 19, 2016-12:46:45 ; LAYOUT: Layout1-B (LS)

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

Sample results will be submitted to the OCD's Environmental Bureau (Santa Fe). Provided the sample results indicate that no contamination persists at the Facility in excess of allowable levels, OWL will proceed with final site closure and post-closure activities. If contamination is observed at 42 inches, sampling and excavation will continue to the depth where no contamination is observed.

2.8 Final Site Closure – Processing Area

Upon OCD determination that no contamination is present at OWL 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

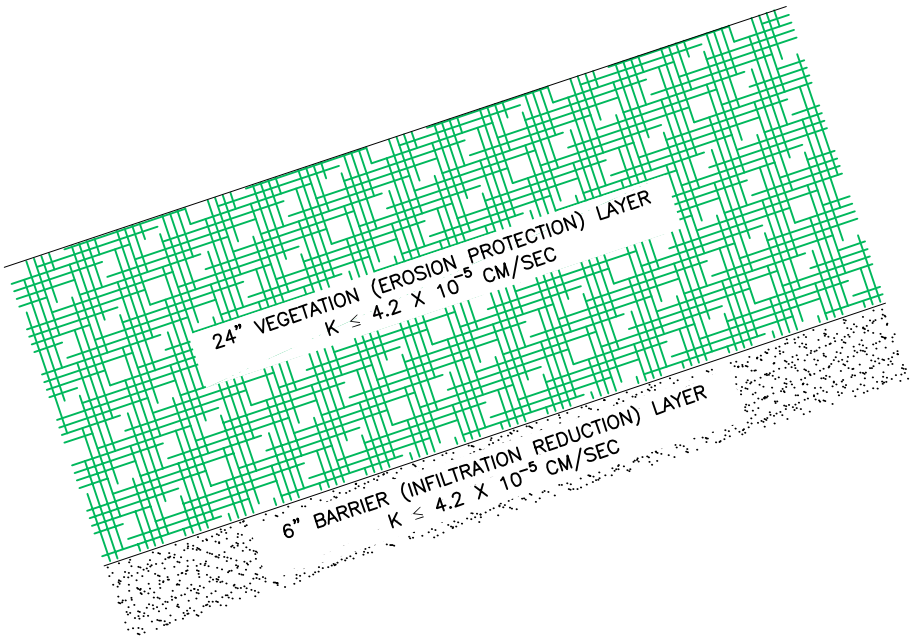
Re-vegetation of the OWL site (equal to 70% of the native perennial vegetative cover) will be conducted during the optimum planting period, whenever possible. Examples of seed types identified and recommended by the NRCS as acceptable cover for the local and are described in **Table II.4.3.** OWL is seeking an exception to the Oil & Gas Rule in order to have the option for stabilization methods alternative to vegetation; if needed. Alternative stabilization options for final cover are presented in **Attachment II.4.A**. The Closure Documentation Record (**Attachment II.4.B**), 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 environmental engineering, will supervise closure construction and certify completion of closure activities.

2.9 Final Site Closure - Solid Waste Disposal Area

It is anticipated that the OWL Landfill will be the final area closed at the OWL Facility due to the need for disposal of wastes from other on-site process units under premature or planned final closure conditions. Final cover will be installed within one year of achieving the final waste elevations, or an intermediate grading plan approved by OCD under early closure. The overall final grading contours for the Landfill are provided in the **Permit Plans, Sheet 5**. The final cover proposed for the OWL Landfill includes an alternative crown and sideslope evaporation/transpiration ("ET") cap configuration.

The alternative ET cap configuration will consist of a 24-inch vegetative (erosion) layer; a 6-inch barrier (infiltration) layer ($k \leq 4.2 \times 10^{-5}$ 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 is proven to provide superior performance in preventing liquid migration through the cover when compared to the prescriptive cap outlined in the regulations.

Final slopes will be constructed in accordance with the Final Grading Plan (**Permit Plans, Sheet 5**). The sideslopes will be no greater than 16% and the top crown will be constructed at a design grade of 2.0%. Details for the final cover design are shown on the **Permit Plans, Sheet 10**. 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 are provided in **Table II.4.3**:



LANDFILL FINAL COVER SECTION

FINAL COVER PROFILE

OWL LANDFILL SERVICES, LLC.
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: 08/29/2016	CAD: FINAL COVER.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.4.3
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\RAI 1\FINAL COVER.dwg
Date/Time:Sep. 07, 2016-13:15:23

TABLE II.4.3
NRCS Recommended Seed Mix
OWL Landfill Services, LLC[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*

In addition, alternative stabilization options are provided in **Attachment II.4.A**. The Closure Documentation Record (**Attachment II.4.B**), 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 also certify the closure.

2.10 Miscellaneous Building and Structure Removal

At this time, it is anticipated that, following closure, the OWL Facility 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, buildings and miscellaneous structures will be dismantled and, where practical, recycled or reused. Non-recyclable material will be disposed of in the OWL Landfill, or other OCD-approved landfill. Once buildings, structures and sumps are removed, these areas will be inspected for contamination (see Site Sampling, Section 2.7). 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

OWL 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 OWL has not established a use for the Facility after closure beyond open space/live-stock grazing or oil and gas exploration/development activities. Should a specific use be determined, OWL 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 groundwater pursuant to 19.15.30 and 19.15.29 NMAC.

3.0 POST-CLOSURE PLAN

3.1 Post-Closure Maintenance

Landfill Area

OWL will monitor and provide post-closure maintenance for the OWL Landfill for a period of not less than 30 years, or as otherwise approved by OCD. During the post-closure care period, OWL proposes to inspect and maintain the site at least semi-annually, and immediately after a documented 24 hour, 25-year storm event, whichever is more frequent, utilizing the Site Inspection Checklist (**Attachment II.4.C**). Upon successful re-vegetation efforts resulting in at least 70% coverage (not including noxious weeds) or other approved erosion control methods (see **Attachment II.4.A**), OWL 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., potential gas migration)

In addition, vadose zone monitoring will be performed and reported on an annual basis; or a reduced frequency if negative results warrant, pursuant to OCD approval.

Processing Area

OWL will conduct semi-annual 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, OWL will implement corrective measures. Should a documented release to the vadose zone or groundwater occur, OWL 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 Estimates (**Attachment II.4.D**) for the closure and post-closure activities described in this Plan are presented in current dollars; and conservatively assume that third party contractors will perform closure and post closure activities at the site, as required by 19.15.36.8.C(9) NMAC. The C/PC Cost Estimates assume that no contamination or remedial activities are required due to releases into the environment.

The current estimates for Phase I (**Table II.4.1**) of OWL closure construction and post-closure operations are provided as **Attachment II.4.D**. These estimates will be revised accordingly as additional Phases (**Table II.4.1**) of OWL construction and operations are implemented, or should unforeseen conditions arise; as well as annually once a Phase of Development is complete. Upon Division approval of the requested Permit, OWL will select a financial assurance mechanism pursuant to 19.15.36.11.E NMAC; and will submit the appropriate documentation to OCD based on the estimates provided in this Plan prior to OCD issuance of the Permit.

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, etc.), and after OCD concurrence, OWL 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 cover stabilization in accordance with the regulations, OWL will request release from the remaining financial assurance requirements for the Facility or portions that have been successfully closed.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

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

ATTACHMENT II.4.A

ALTERNATIVE STABILIZATION OPTIONS FOR INTERMEDIATE AND FINAL COVER

ATTACHMENT II.4.A
Alternative Stabilization Options for Intermediate and Final Cover
OWL Landfill Services, LLC

OWL Landfill Services, LLC (OWL) proposes an "exception" per 19.15.36.19.A NMAC to the Oil & Gas Rules for stabilization of intermediate and final cover with vegetation, i.e., 19.15.36.14.A(7)(b) NMAC and 19.15.36.18.D(2)(b) NMAC, respectively. OWL proposes the use of sustainable alternative stabilization materials and methods as may be needed where vegetation cannot be adequately established as required for both intermediate and final cover.

Intermediate Cover Stabilization
OWL may implement the use of alternative methods of cover stabilization for areas of intermediate cover which have been inactive for greater than two years and have not been adequately stabilized with vegetation.

Final Cover Stabilization
In addition, for areas that will receive final cover, OWL plans to implement these methods for the vegetative (erosion) layer where vegetation has not been adequately established. Final cover is required to include a layer for minimizing erosion which is a minimum of twelve inches thick and capable of sustaining native plant growth (19.15.36.14.C(8) NMAC).

Alternative Stabilization Materials and Methods
For those areas that have not been successfully stabilized with vegetation as required for intermediate or final cover, OWL will implement the use of one or more alternative stabilization options:

- Compost/organics
- Wood chips/shredded green waste
- Mixtures (e.g., compost, wood chips, soil)
- Vertical tracking of slopes
- Gravel/rock (to simulate desert pavement)
- Inert fill
- Bermed materials

Materials such as compost, wood chips, shredded green waste, mixtures of organic materials, gravel, etc. may be applied at depths determined to be effective based on potential pilot study evaluations and experience. Berms comprised of organic or crushed inert materials may be constructed perpendicular to the intermediate or final cover slopes to aid in the mitigation of wind and water erosion. In addition, vertical tracking of slopes with a dozer to allow the dozer's track segment grouser pattern to imprint the soil and slow the progress of water and wind erosion may also be implemented.

Inspection, Repair, and Maintenance
Areas that have intermediate cover will be inspected at least once per month and after significant rain events as described **Attachment II.1.G**. Final cover inspection will be conducted at least quarterly during the initial post-closure phase as detailed in the Closure/Post-Closure Plan (**Volume II.4**), Section 3.1.

Approval for Alternative Stabilization Methods
Alternative stabilization methods may be implemented upon approval from the Oil Conservation Division.

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OWL LANDFILL SERVICES, LLC

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ATTACHMENT II.4.B

CLOSURE DOCUMENTATION RECORD (TYPICAL)

ATTACHMENT II.4.B
Closure Documentation Record (Typical)
OWL Landfill Services, LLC

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: _____

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
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ATTACHMENT II.4.C

POST-CLOSURE SITE INSPECTION CHECKLIST (TYPICAL)

ATTACHMENT II.4.C
Post-Closure Site Inspection Checklist (Typical)
OWL Landfill Services, LLC

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: _____

_____

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

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SECTION 4: CLOSURE/POST-CLOSURE PLAN

ATTACHMENT II.4.D

CLOSURE/POST-CLOSURE COST ESTIMATES

ATTACHMENT II.4.D.1
PHASE I CLOSURE/POST-CLOSURE
COST ESTIMATE SUMMARY
OWL Landfill Services, LLC

TASK	COST ESTIMATE
1.0 LANDFILL CLOSURE CONSTRUCTION	**$863,780**
2.0 LANDFILL MAINTENANCE	**$389,400**
3.0 ENVIRONMENTAL MONITORING	**$75,900**
4.0 POND AND PROCESSING AREA CLOSURE (see Att. II.4.D.5)	**$416,194**
5.0 POND AND PROCESSING AREA MAINTENANCE	**$62,040**
TOTAL COST ESTIMATE	**$1,807,314**

ATTACHMENT II.4.D.2
PHASE I LANDFILL CLOSURE CONSTRUCTION
CLOSURE COST ESTIMATE
OWL Landfill Services, LLC Landfill (Unit 1 - 34.8 acres ±)

TASK 1.0	Unit Quantity	Unit	Unit Cost	Total Cost
1.1 Final Cover Installation				
1.1.1 Install and compact 12" Intermediate Cover Layer	56,088	CY	$2.50	$140,220
1.1.2 Install and compact 24" Barrier Layer	112,176	CY	$3.50	$392,615
1.1.3 Install 12" Vegetative Layer	56,088	CY	$2.50	$140,220
1.1.4 Vegetative Layer Seeding (Class A)	34.8	AC	$1,500.00	$52,200
			Task Subtotal	**$725,255**
1.2 Final Cover CQA				
1.2.1 Inspection and Testing	1	LS	$50,000	$50,000
1.2.2 Certification	1	LS	$10,000	$10,000
			Task Subtotal	**$60,000**
			TASK TOTALS	**$785,255**
			Independent Project Manager and Contract Administration Cost (10% of Task Totals)	$78,525
			TOTAL COST	**$863,780**

Notes:

1. Phase I 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 34.8 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.D.3
PHASE I LANDFILL MAINTENANCE
POST-CLOSURE COST ESTIMATE
OWL Landfill Services, LLC

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	$1,000	$2,000	$60,000
2.1.2 Recordkeeping and Reporting	2	events/yr	$400	$800	$24,000
			Task Subtotals	**$2,800**	**$84,000**
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	events/yr	$400	$400	$12,000
2.3.2 Disposal	1	events/yr	$1,000	$1,000	$30,000
			Task Subtotals	**$1,400**	**$42,000**
2.4 Surface Water Management Systems					
2.4.1 Inspection/Repairs	4	events/yr	$600	$2,400	$72,000
			Task Subtotals	**$2,400**	**$72,000**
2.5 Fencing					
2.5.1 Inspection/Repairs	2	events/yr	$600	$1,200	$36,000
			Task Subtotals	**$1,200**	**$36,000**
			TASK TOTALS	**$11,800**	**$354,000**
			Independent Project Manager and Contract Administration Cost (10% of Task Totals)	$1,180	$35,400
			TOTAL COST	**$11,800**	**$389,400**

Notes:

1. Phase I 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.D.4
PHASE I ENVIRONMENTAL MONITORING
POST-CLOSURE COST ESTIMATE
OWL Landfill Services, LLC

TASK 3.0	Unit Quantity	Unit	Unit Cost	Total Cost Per Year	Total Cost
3.1 Vadose Zone Monitoring					
3.1.1 Field Services/Lab Analysis/Reporting (30 years)	1	events/yr	$2,300	$2,300	$69,000
			Task Subtotal	**$2,300**	**$69,000**
			TASK TOTALS	**$2,300**	**$69,000**
			Independent Project Manager and Contract Administration Cost (10% of Task Totals)	$230	$6,900
			TOTAL COST	**$2,530**	**$75,900**

Notes:

1. Phase I 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).

ATTACHMENT II.4.D.5
PHASE I POND AND PROCESSING AREA CLOSURE CONSTRUCTION
CLOSURE COST ESTIMATE
OWL Landfill Services, LLC

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	CY	$4.00	200	$ 800
4.1.1.6 Disposal Liner	CY	$4.25	200	$ 850
			Task Subtotal	**$ 106,358**
4.1.2 Pond Backfill and Contouring				
4.1.2.1 Soil On-site	CY	$1.00	0	$ -
4.1.2.2 Place and Compact Soil	CY	$3.00	15,000	$ 45,000
			Task Subtotal	**$ 45,000**
4.1.3 Sampling	each	$200	300	$ 60,000
4.1.4 Seeding	acres	$1,500	28	$ 42,000
			Task Subtotal	**$ 102,000**
Pond Closure Subtotal:			**$**	**253,358**
4.2 Site Work				
4.2.1 Tank Removal		LS	$	25,000
4.2.2 Building Removal		LS	$	25,000
4.2.3 Process Equipment Removal		LS	$	25,000
4.2.4 Earthwork		LS	$	10,000
Site Work Subtotal:			**$**	**85,000**
4.3 Engineering				
4.3.1 CQA/Certification		LS	$	40,000
Engineering Subtotal:		LS	**$**	**40,000**
4.4 Totals				
4.4.1 Subtotal			$	378,358
4.4.2 Adminstration Cost (10%)			$	37,836
		Total:	**$**	**416,194**

Notes:

1. Phase I 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 transported up to 50 miles for disposal.
3. Assume 6" of sludge remaining in each pond at closure transported up to 50 miles for disposal.
4. Site Sampling is conducted during the CQA phase.
5. CY = Cubic Yard
   LS = Lump Sum

ATTACHMENT II.4.D.6
PHASE I POND AND PROCESSING AREA MAINTENANCE
POST-CLOSURE COST ESTIMATE
OWL Landfill Services, LLC

TASK 5.0	Unit Quantity	Unit	Unit Cost	Total Cost Per Year	Total Cost For 3 Years
5.1 Surface Inspection and Reporting					
5.1.1 Inspection	2	events/yr	$1,000	$2,000	$6,000
5.1.2 Recordkeeping and Reporting	2	events/yr	$400	$800	$2,400
			Task Subtotals	**$2,800**	**$8,400**
5.2 Surface Maintenance					
5.2.1 Cover Maintenance	1	AC/yr	$1,000	$1,000	$3,000
5.2.2 Vegetation	2	AC/yr	$1,500	$3,000	$9,000
			Task Subtotals	**$4,000**	**$12,000**
5.3 Fencing					
5.3.1 Inspection/Repairs	2	events/yr	$600	$1,200	$3,600
			Task Subtotals	**$1,200**	**$36,000**
			TASK TOTALS	**$8,000**	**$56,400**
Independent Project Manager and Contract Administration Cost (@ 10%)				$800	$5,640
			TOTAL COST	**$8,000**	**$62,040**

Notes:

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

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

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

ATTACHMENT II.4.E

FINANICAL ASSURANCE DOCUMENTATION

(TO BE PROVIDED UPON PERMIT APPROVAL)

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 5: CONTINGENCY PLAN

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OWL LANDFILL SERVICES, LLC

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APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 5: CONTINGENCY PLAN

1.0 INTRODUCTION

OWL Landfill Services, LLC (OWL) is proposing to permit, construct, and operate a "Surface Waste Management Facility" for oil field waste processing and disposal services. The proposed OWL Facility is subject to regulation under the New Mexico (NM) Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility has been designed in compliance with the requirements of 19.15.36 NMAC, and will be constructed, operated, and closed in compliance with a Surface Waste Management Facility Permit issued by the OCD.

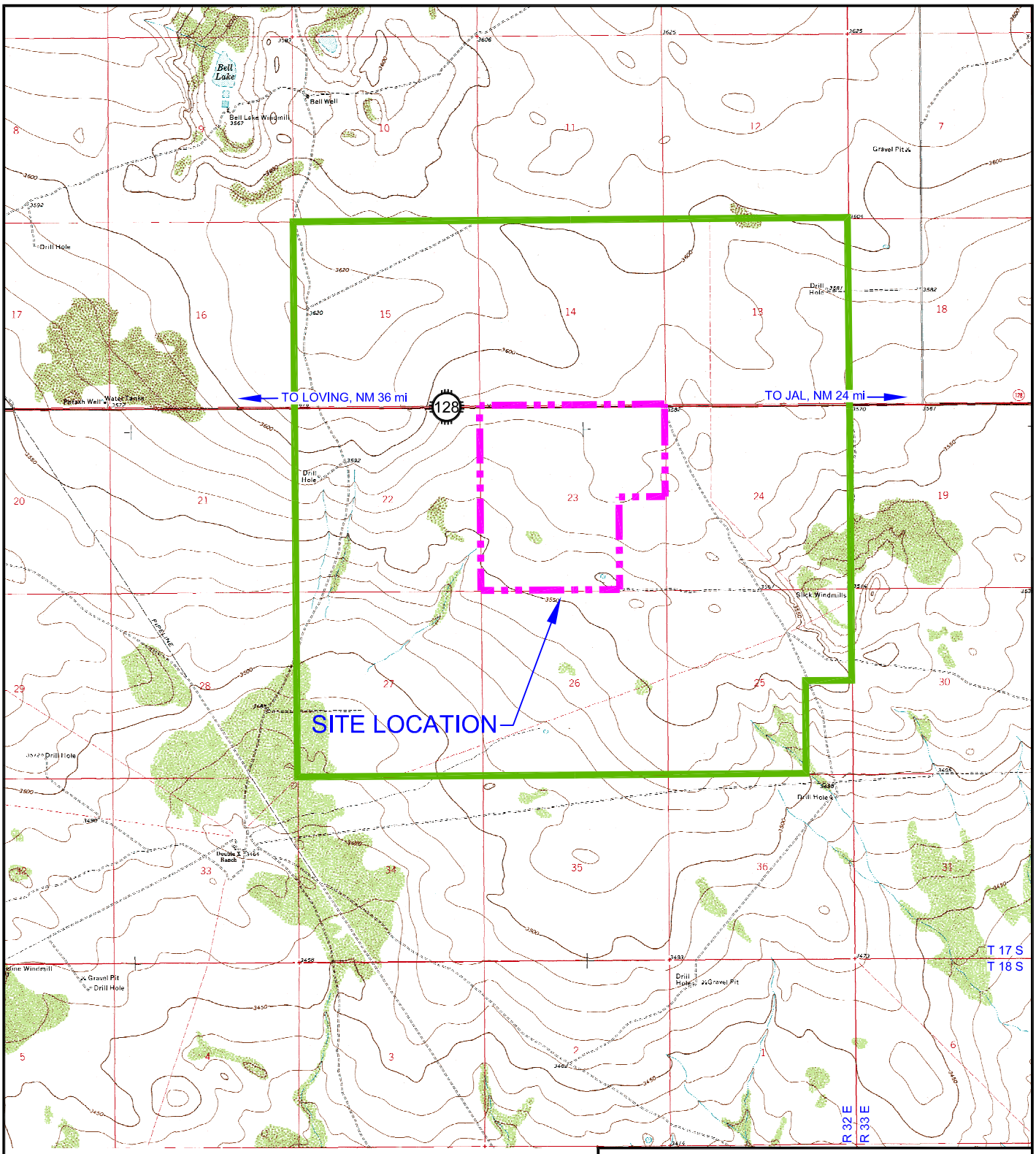
The OWL Facility is one of the first designed to the new more stringent standards that, for instance, mandate double liners and leak detection for land disposal. The new services that OWL will provide fill a necessary void in the market for technologies that exceed current OCD requirements.

1.1 Site Location

The OWL site is located approximately 22 miles northwest of Jal, adjacent to the south of NM 128 in Lea County, NM. The OWL site is comprised of a 560-acre ± tract of land located within a portion of Section 23, Township 24 South, Range 33 East, Lea County, NM (**Figure II.5.1**). Site access will be provided on the south side of NM 128. The coordinates for the approximate center of the OWL site are Latitude 32.203105577 and Longitude -103.543122319 (surface coordinates).

1.2 Facility Description

The OWL Surface Waste Management Facility will comprise approximately 500 acres of the 560-acre site, and will include two main components: an oil field waste Processing Area and an oil field waste Landfill, as well as related infrastructure. Oil field wastes are anticipated



LEGEND

SITE BOUNDARY

1 MILE OFFSET FROM SITE

NOTES:

1) SITE IS LOCATED WITHIN A PORTION OF SECTION 23, TOWNSHIP 24 SOUTH RANGE 23 EAST, LEA COUNTY, NEW MEXICO

2) MAP REFERENCE:
BELL LAKE, NM. 1973 USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP

NORTH

0 2000' 4000'

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\SITE LOCATION.dwg
Date/Time:Sep. 20, 2016-08:14:04 ; LAYOUT: A (P)

SITE LOCATION MAP

OWL LANDFILL SERVICES, LLC
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: 09/20/2016	CAD: SITE LOCATION.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.5.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

to be delivered to the OWL Facility from oil and gas exploration and production operations in southeastern NM and west Texas. The Permit Plans (**Attachment III.1.A**) identify the locations of the Processing Area and Landfill facilities. 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.

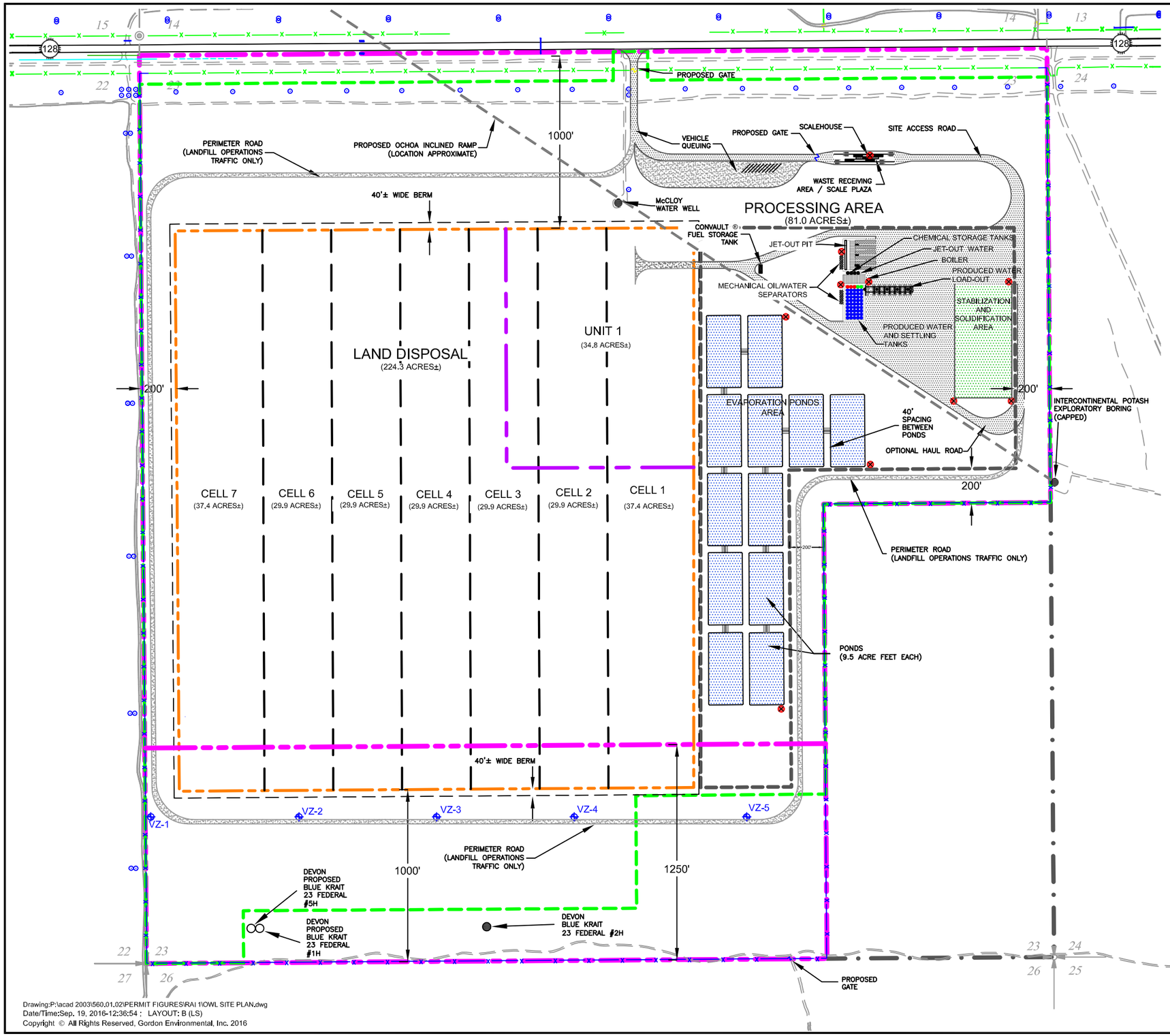
TABLE II.5.1
Proposed Facilities[1]
OWL Landfill Services, LLC

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 – bays	6

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 innovations, 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 in conformance with 19.15.36.13.N NMAC. 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.



LEGEND

- SITE BOUNDARY (559.5 ACRES±)
- FACILITY BOUNDARY (500.0 ACRES)
- DISPOSAL AREA (224.3 ACRES±)
- PROCESSING AREA (81.0 ACRES±)
- UNIT 1 BOUNDARY (34.8 ACRES±)
- CELL BOUNDARY
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING FENCE
- EXISTING POWER POLE
- EXISTING CULVERT
- PROPOSED 3–STRAND BARBED WIRE FENCE
- PROPOSED UNPAVED ROAD (GRAVEL)
- PROPOSED UNPAVED ROAD (SOIL)
- VZ-2 PROPOSED VADOSE ZONE MONITORING WELL
- PPE AND EMERGENCY EQUIPMENT

NORTH

0 300' 600'

SITE PLAN

OWL LANDFILL SERVICES, LLC
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: 09/16/2016	CAD: SITE PLAN.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.5.2
APPROVED BY: IKG	gei@gordonenvironmental.com	

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 Scalehouse. 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 OWL (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

OWL 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 OWL 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 promptly 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 OWL 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
OWL Landfill Services, LLC

Agency/Organization	Emergency Number
1. Fire	
Jal Fire Department	911 or (575) 395-2221
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
Jal Community Hospital 805 W. Kansas Avenue Jal, NM 88252	(575) 395-3400
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	
Environmental Emergency 24 hr. (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) 391-2983
8. Federal Emergency Response Contacts	
National Emergency Response Center (U.S. Coast Guard)	(800) 424-8802
Region VI Emergency Response Hotline (USEPA)	(214) 665-2200

TABLE II.5.3
Definitions
OWL Landfill Services, LLC

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
OWL Landfill Services, LLC

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 OWL 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 OWL Facility. It is unlikely that defined hazardous wastes will be delivered to this Facility, and OWL will implement a waste inspection and screening program at the Facility Scalehouse to preclude acceptance of unauthorized wastes as described in the Oil Field Waste Management Plan (**Volume II.2**). The OCD Form C-138 (Request for Approval to Accept Solid Waste) 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

OWL 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 Facility Scalehouse 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]
OWL Landfill Services, LLC

Equipment Description	Quantity	Location	Use(s)
10 lb ABC rated fire extinguisher (1 min)	2	Scalehouse	Firefighting
10 lb ABC rated fire extinguisher (1 min)	1 per vehicle	Trucks	Firefighting
10 lb ABC rated fire extinguisher (1 min)	1 per vehicle	Heavy Equipment	Firefighting
20 lb ABC rated fire extinguisher (2 min)	1	Oil Process Tanks	Firefighting
20 lb ABC rated fire extinguisher (2 min)	1	Oil Sales Tanks	Firefighting
20 lb ABC rated fire extinguisher (2 min)	1	Produced Water Receiving Tanks	Firefighting
20 lb ABC rated fire extinguisher (2 min)	1	Diesel Storage Tank	Firefighting
Loader (5 cy)	1	Facility	Berm Repair & Smothering Fires
Oil Booms (200 ft)	4	NE Corner of Ponds	Oil Containment
Self-contained Breathing Apparatus	1 per employee	Scalehouse	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	Scalehouse	Contain spillage, putting out fires
First Aid Kit	1	Scalehouse	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 Scalehouse	Communications
Cell Phones (Unlimited Range)	min. 3	Facility Manager Facility Operator Facility Operator	Communications
Office Phone	2	Scalehouse	Communications
Mobile pressure washer	1	Mobile	Decontaminating equipment

Notes:

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

- 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)
OWL Landfill Services, LLC

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 OWL 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:** OWL 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 OWL 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). Following 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:

- implement immediate response procedures
- provide notifications to appropriate agencies
- implement appropriate recordkeeping procedures and Plan amendments

This assessment provides the EC with critical data needed to determine whether an evacuation is necessary, whether emergency authorities are needed, and whether OWL 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 per 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 the type of waste materials proposed for receipt at OWL and the rigorous operational safety protocols prescribed, 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 OWL Facility is required. Imminent or actual concerns 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 Facility Scalehouse for directions, OWL's primary evacuation route. OWL 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
OWL Landfill Services, LLC

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.

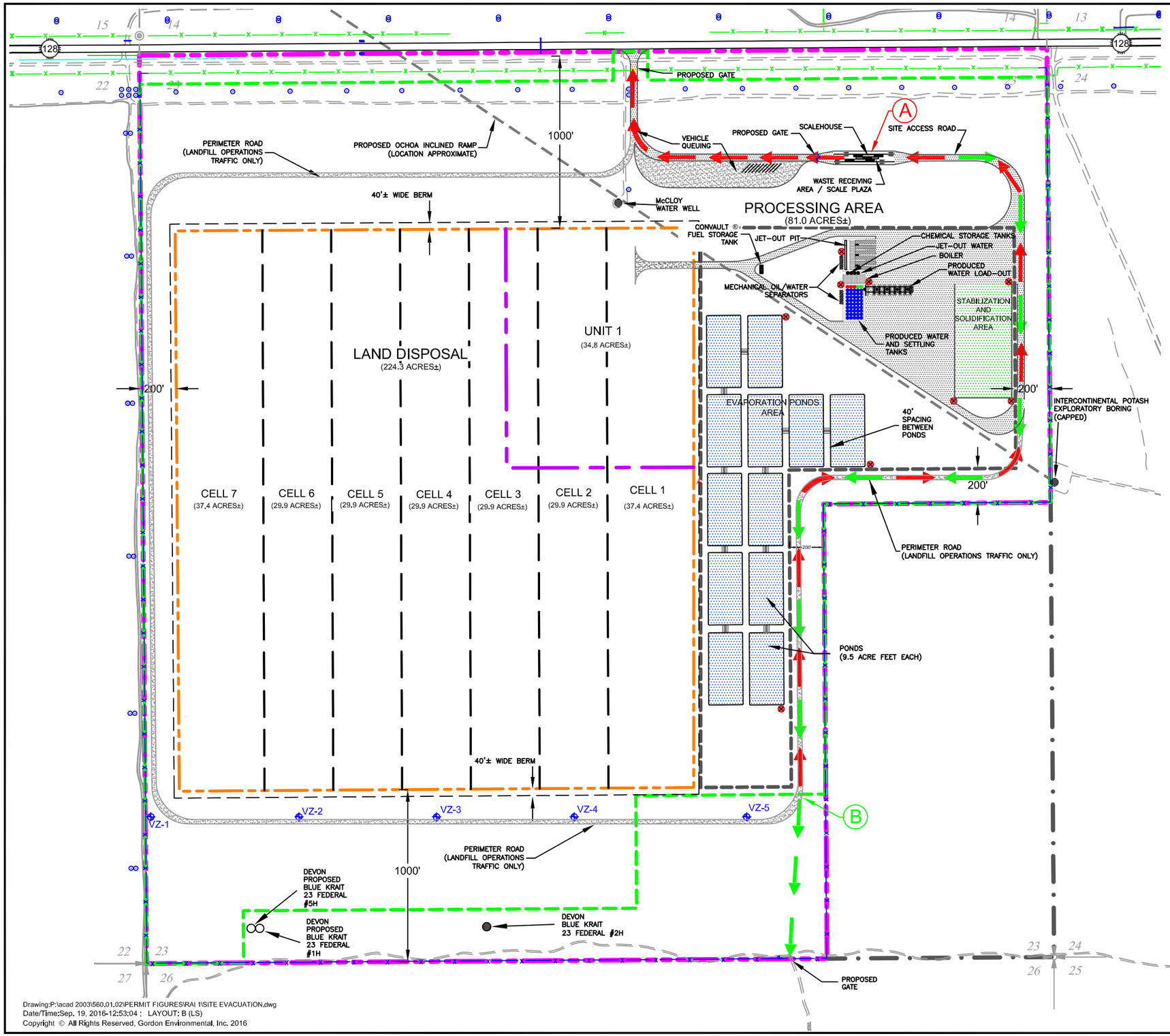
B. The person shall report a minor release by giving timely written notice pursuant to Subsection B of 19.15.29.10 NMAC.

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.



LEGEND

- SITE BOUNDARY (559.5 ACRES±)
- FACILITY BOUNDARY (500.0 ACRES)
- DISPOSAL AREA (224.3 ACRES±)
- PROCESSING AREA (81.0 ACRES±)
- UNIT 1 BOUNDARY (34.8 ACRES±)
- CELL BOUNDARY
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING FENCE
- EXISTING POWER POLE
- EXISTING CULVERT
- PROPOSED 3-STRAND BARBED WIRE FENCE
- PROPOSED UNPAVED ROAD (GRAVEL)
- PROPOSED UNPAVED ROAD (SOIL)
- VZ-2 PROPOSED VADOSE ZONE MONITORING WELL
- PPE AND EMERGENCY EQUIPMENT
- PRIMARY EVACUATION ROUTE
- SECONDARY EVACUATION ROUTE
- A PRIMARY MEETING LOCATION
- B SECONDARY MEETING LOCATION

NORTH

0 300' 600'

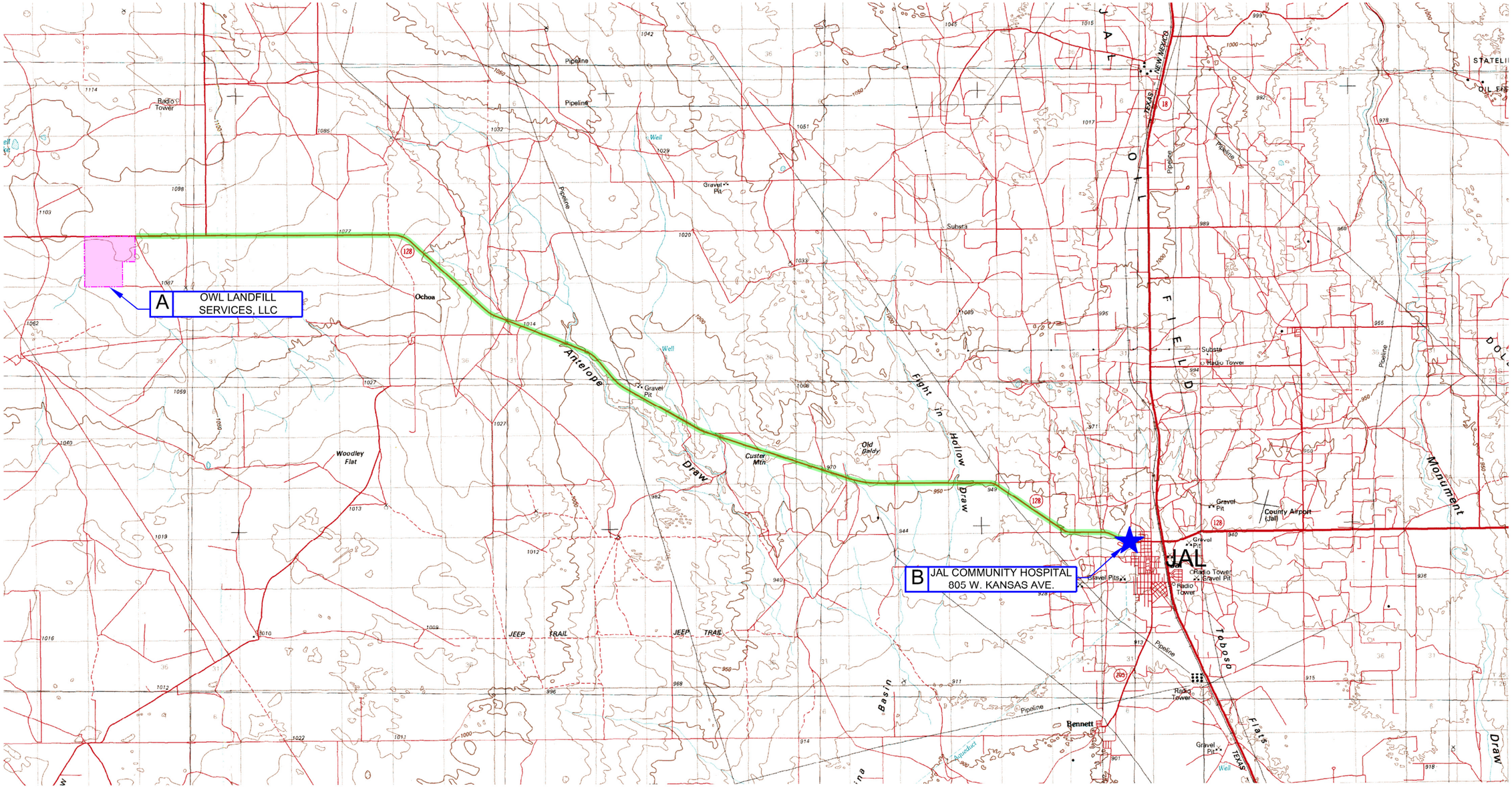
SITE EVACUATION MAP

OWL LANDFILL SERVICES, LLC
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: 09/16/2016	CAD: SITE EVACUATION.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.5.3
APPROVED BY: IKG	gei@gordonenvironmental.com	

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\RAI 1\SITE EVACUATION.dwg
Date/Time:Sep. 19, 2016-12:53:04 ; LAYOUT: B (LS)



A: OWL LANDFILL SERVICES, LLC. NM 529

1. Head EAST on NM-128 toward JAL 23.17 mi
2. Arrive 805 W. KANSAS AVE. (PH 575-395-3400) 0.0 mi

B: JAL COMMUNITY HOSPITAL 805 WEST KANSAS AVE. JAL, NM 88252

Note: A to B Travel Estimates: 25 minutes / 23.17 miles

HOSPITAL LOCATION MAP

OWL LANDFILL SERVICES, LLC
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: 09/20/2016	CAD: HOSPITAL LOCATION.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.5.4
APPROVED BY: IKG	gei@gordonenvironmental.com	

MAP REFERENCE:
USGS JAL QUADRANGLE
NEW MEXICO–TEXAS 1:100,000 SCALE SERIES 1978

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\HOSPITAL LOCATION.dwg
Date/Time:Sep. 20, 2016-09:28:52 ; LAYOUT: B (LS)

TABLE II.5.8
Evacuation Procedures
OWL Landfill Services, LLC

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

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 Facility Scalehouse, which will be the primary meeting location (**Figure II.3.4**). The EC will identify missing persons at that time.
5. If the emergency involves the 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.5.2 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.5.2** will be posted prominently near on-site telephones and provided as handouts to OWL personnel, customers, response personal, etc. Fire, police, and medical authorities should be contacted as necessary in an emergency situation (**Table II.5.2**). 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 $H_2S \geq 10$ 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.5.2**):

- 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) 391-2983

OWL will also notify Phoenix Environmental, a third-party response specialist (if necessary) in Hobbs (**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 by the EC. If the EC determines that the incident could threaten fresh water, human health, public safety or the environment beyond the limits of the OWL 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.5.2**):

- National Response Center - 24 Hr. Hotline: (800) 424-8802
- NMED Environmental 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

Recordkeeping will be recorded as detailed in Section 8.0, and Plan Amendments accomplished in accordance with Section 10.0.

5.0 CONTROL PROCEDURES

This section provides information for the EC and OWL 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 OWL 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 OWL 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 OWL 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 OWL:

TABLE II.5.9
Fire/Explosion: Control Guidelines
OWL Landfill Services, LLC

1. **INITIATE FIRE CONTROL:** The EC and OWL 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. Water will not be used on petroleum fires.
5. **EVACUATE AND NOTIFY EMERGENCY AUTHORITIES:** If at any time the scope of the fire is beyond the capabilities of OWL 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 OWL 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
OWL Landfill Services, LLC

1. **INITIATE CONTROL:** The EC and OWL 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.5.2**) 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 OWL 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 within 5 days.

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 OWL 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) and (13) NMAC).

7.0 EMERGENCY EQUIPMENT

The following sections describe emergency equipment that is available at OWL 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 OWL Facility will be accomplished via cellular telephones, land lines, two-way radios, etc. 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 listed on **Table II.5.5**.

7.2 External Communications

The telephones located at OWL 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 (hard-line) telephone. Emergency phone numbers will be posted in the Facility Scalehouse and provided to employees and key customers on laminated pocket cards. 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 Facility Scalehouse, 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 (Facility Scalehouse, 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 OWL Facility (**Table II.5.5**). 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 Facility Scalehouse 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 an 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 OWL Facility Operating Record.

In addition, in the case of an unauthorized release at the OWL Facility, the OCD will be notified pursuant to 19.15.29 NMAC. As defined by OCD in **Table II.5.3**, 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.5.7**) 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.5.7**) 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 OWL Facility Operating Record.

9.0 COORDINATION AGREEMENTS

A copy of the Contingency Plan will be made available to the organizations identified in **Table II.5.2**. 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. Amendments to the Contingency Plan will be made within five working days 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.5.2** with a cover letter highlighting substantive changes. Proposed changes will be in compliance with 19.15.36.13.N NMAC.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 5: CONTINGENCY PLAN

ATTACHMENT II.5.A

REQUEST FOR APPROVAL TO ACCEPT SOLID WASTE

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
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 5: CONTINGENCY PLAN

ATTACHMENT II.5.B

INCIDENT REPORT FORM (TYPICAL)

INCIDENT REPORT FORM
OWL Landfill Services, LLC

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
OWL Landfill Services, LLC

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
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 5: CONTINGENCY PLAN

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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VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 6: MIGRATORY BIRD PROTECTON PLAN

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1.0 INTRODUCTION

OWL Landfill Services, LLC (OWL) is proposing to permit, construct, and operate a "Surface Waste Management Facility" for oil field waste processing and disposal services. The proposed OWL Facility is subject to regulation under the New Mexico (NM) Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility has been designed in compliance with the requirements of 19.15.36 NMAC, and will be constructed, operated, and closed in compliance with a Surface Waste Management Facility Permit issued by the OCD.

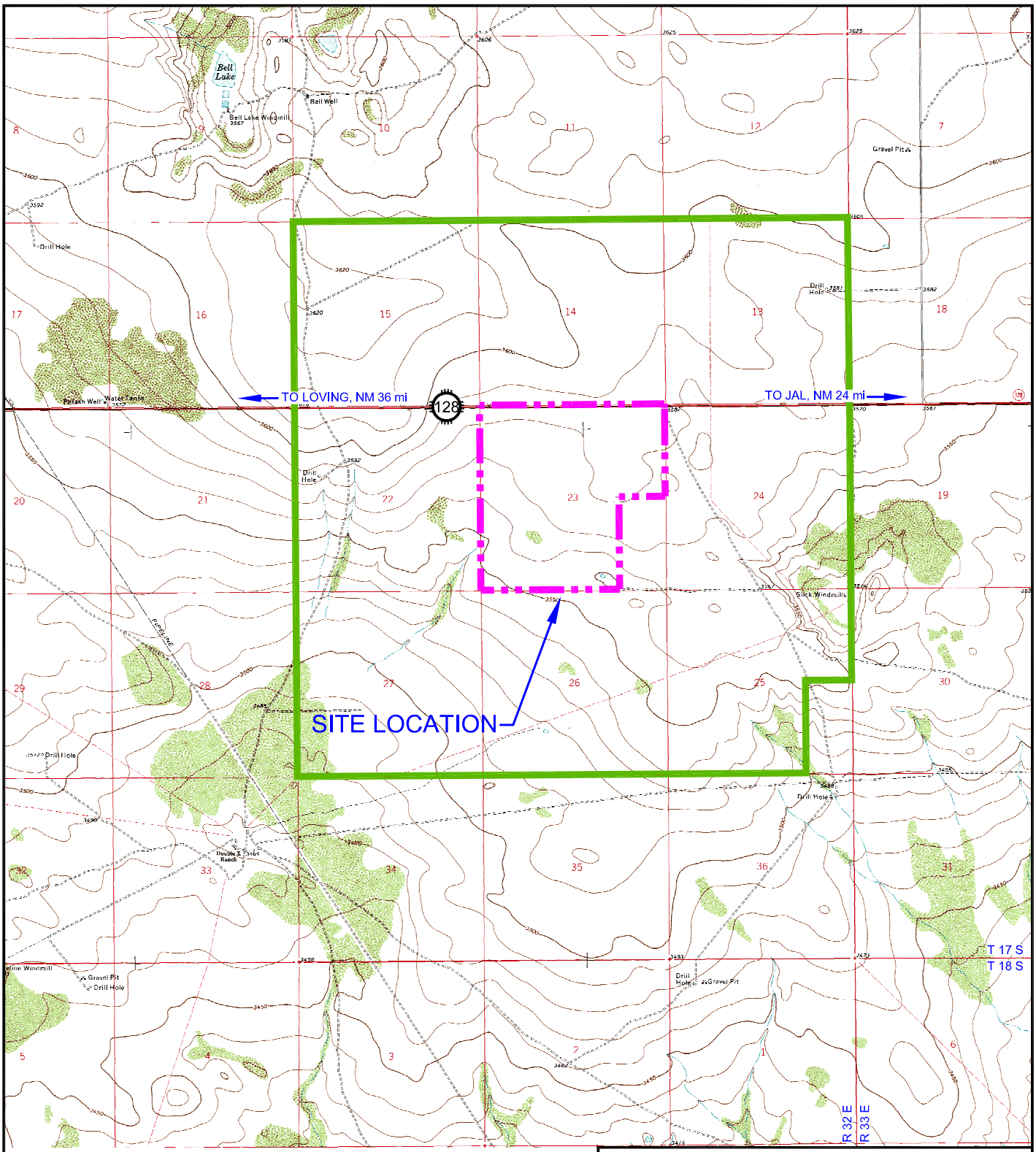
The OWL Facility is one of the first designed to the new more stringent standards that, for instance, mandate double liners and leak detection for land disposal. The new services that OWL will provide fill a necessary void in the market for technologies that exceed current OCD requirements.

1.1 Site Location

The OWL site is located approximately 22 miles northwest of Jal, adjacent to the south of NM 128 in Lea County, NM. The OWL site is comprised of a 560-acre ± tract of land located within a portion of Section 23, Township 24 South, Range 33 East, Lea County, NM (**Figure II.6.1**). Site access will be provided on the south side of NM 128. The coordinates for the approximate center of the OWL site are Latitude 32.203105577 and Longitude -103.543122319 (surface coordinates).

1.2 Description

The OWL Surface Waste Management Facility will comprise approximately 500 acres of the 560-acre site, and will include two main components: an oil field waste Processing Area and an oil field waste Landfill, as well as related infrastructure. Oil field wastes are anticipated



LEGEND

SITE BOUNDARY

1 MILE OFFSET FROM SITE

NOTES:

1) SITE IS LOCATED WITHIN A PORTION OF SECTION 23, TOWNSHIP 24 SOUTH RANGE 23 EAST, LEA COUNTY, NEW MEXICO

2) MAP REFERENCE:
BELL LAKE, NM. 1973 USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP

NORTH

0 2000' 4000'

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\SITE LOCATION.dwg
Date/Time:Sep. 20, 2016-08:17:44 ; LAYOUT: A (P)

SITE LOCATION MAP

OWL LANDFILL SERVICES, LLC
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: 09/20/2016	CAD: SITE LOCATION.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.6.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

to be delivered to the OWL Facility from oil and gas exploration and production operations in southeastern NM and west Texas. The **Permit Plans** (**Attachment III.1.A**) identify the locations of the Processing Area and Landfill facilities.

1.3 Purpose

This Migratory Bird Protection Plan (the Plan) for the OWL 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 OWL. OWL is not proposing to install screening, netting or covering over the evaporation ponds. Instead, OWL 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 comparable protection of migratory birds.

This Plan may be modified by OWL 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. OWL will coordinate with USEPA Region 6 regarding this Plan if so directed by OCD.

2.0 MIGRATORY BIRD PREVENTION

2.1 Siting Perspective

OWL proposes an exception to the screening/netting requirements of 19.15.36.17.C(3) NMAC, although OWL plans to meet the requirements of this Rule through an alternative monitoring method described herein. Additionally, OWL 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 migratory birds congregating around, or landing in, the vicinity of the OWL 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, despite the National Wetlands Institute's wetland designation of a

portion of a depressional feature located 500 ft to the southeast of the facility, which is inundated only intermittently based on site reconnaissance.

2.2 Human and Mechanical Intervention

OWL Processing Area operations, as proposed in this Application, have been designed to eliminate oil from accumulation on the evaporation ponds (**Volume II.1**). 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, typically 24 hours per day. The Facility Manager, operators and employees will conduct periodic (every fifteen minutes) inspection rounds making note of 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 (www.bird-rescue.org) are provided in **Table II.6.1**.

TABLE II.6.1
Bird Rescue Protocol
OWL Landfill Services, LLC

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

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SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

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
- The Construction Plans and Technical Specifications for each new Unit.

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. Additionally, the Oil Conservation Division shall be notified at least 72 hours prior to primary liner installation so the leak detection layer may be inspected.

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 CQA 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 greater than 1/2-inch	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

Note: Standard test methods will be updated to reflect the most current standards.

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

Note: Standard test methods will be updated to reflect the most current standards.

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 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.

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-feet (ft) 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. Conformance Testing – Sampling at Manufacturer's Plant

The Owner, Manufacturer and/or independent Quality Assurance Laboratory (QAL) will determine the suitability of either sampling at the Manufacturer's production plant or sampling at the delivered on-site location. Should the parties agree that the independent QAL will collect test samples from the Manufacturer's plant, the following sampling and testing criteria apply:

a. Conformance testing shall be performed by an independent Quality Assurance Laboratory (QAL) approved by the Site CQA Engineer at a minimum frequency of one (1) test per 100,000 ft^2. The sampling frequency may be increased as deemed necessary by the Site CQA Engineer. A representative of the designated QAL shall take samples at the manufacturer's plant location; across the entire roll width and shall not include the first three (3) feet. The following conformance tests shall be conducted at the QAL:
   - Mass per Unit Area (ASTM D 5993)
   - Free Swell (ASTM D 5890)
   - Fluid Loss (ASTM D 5891)
   - Hydraulic Conductivity (ASTM D 5887)

b. These conformance test shall be performed in accordance with test requirements specified in **Table II.7.3**.

c. All conformance tests shall be reviewed by the Site CQA Engineer and accepted or rejected, prior to the deployment of the GCL. All tests results shall meet, or exceed, the property values listed in **Table II.7.3**. In case of failing test results for any individual lot sample, the lot shall be resampled and retested. This retesting shall be at the expense of the Installer or Manufacturer. If all test values from the resamples pass the acceptable certified values listed in **Table II.7.3**.

2. **Conformance Testing – Sampling On-site**

The Owner, Manufacturer and/or independent Quality Assurance Laboratory (QAL) will determine the suitability of either sampling at the Manufacturer's production plant or sampling at the delivered on-site location. Should the parties agree that the independent QAL will collect test samples from delivered products, i.e., on-site sampling, the following sampling and testing criteria apply:

a. 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.

b. 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, one (1) test per one hundred thousand (100,000) square feet (ft^2) of GCL material delivered to the site.
c. 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. Sampling Units shall be one (1) ft wide by roll width, which shall be used for field and Engineer approved Quality Assurance Laboratory (QAL) testing as described below. A measuring device and straight edge shall be used to ensure uniformity of length and width. Mass per unit area, free swell and fluid loss testing shall be performed on delivered rolls by an approved laboratory. The method used for determining specification conformance shall be in accordance with ASTM D4759.
    1) The entire sample unit will be loosely rolled and the width of each sample shall also be measured and recorded.
    2) 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 (5) twelve (12)-inch by six (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.
    3) The five specimens shall be sent to an independent QAL for mass per unit area, free swell (bentonite content) and fluid loss testing (ASTM D5993, ASTM D5890 and ASTM D5891, respectively).
        i. The average of the mass per unit area, free swell and fluid loss of the five specimens will be provided by the independent QAL in accordance with ASTM D4643.
        ii. If any two samples from a given lot being tested for free swell 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 free swell 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.
d. All conformance test results shall be reviewed by the Site CQA Manager and Site CQA Engineer. All lots shall be accepted or rejected, prior to the final placement of the GCL. All test results shall meet, or exceed, the certified 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 all of 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

7.2.1. Conformance Testing – Sampling at Manufacturer's Plant

The Owner, Manufacturer and/or independent Quality Assurance Laboratory (QAL) will determine the suitability of either sampling at the Manufacturer's production plant or sampling at the delivered on-site location. Should the parties agree that the independent QAL will collect test samples from the Manufacturer's plant, the following sampling and testing criteria apply:

a. Conformance testing shall be performed by an independent Quality Assurance Laboratory (QCL) approved by the Site CQA Engineer at a minimum frequency of one (1) test per 100,000 ft^2. The sampling frequency may be increased as deemed necessary by the Site CQA Engineer. A representative of the designated QAL shall take samples at the manufacturer's plant location; across the entire roll width and shall not include the first three (3) feet. The following conformance tests shall be conducted at the QAL:
    - Thickness (ASTM D 5994)
    - Density (ASTM D 1505/0792)
    - Tensile properties (ASTM D 6693)
    - Tear resistance (ASTM D 1004)
    - Carbon black content (ASTM D 4218)
    - Carbon black dispersion (ASTM D 5996)
    - Puncture resistance (ASTM D 4833)
b. These conformance test shall be performed in accordance with test requirements specified in **Table II.7.5**.
c. All conformance tests shall be reviewed by the Site CQA Engineer and accepted or rejected, prior to the deployment of the HDPE FML. All tests results shall meet, or exceed, the property values listed in **Table II.7.5**. In case of failing test results for any individual lot sample, the lot shall be resampled and retested. This retesting shall be at

the expense of the Installer or Manufacturer. If all test values from the resamples pass the acceptable certified values listed in **Table II.7.5**.

7.2.2. Conformance Testing – Sampling On-site

The Owner, Manufacturer and/or independent Quality Assurance Laboratory (QAL) will determine the suitability of either sampling at the Manufacturer's production plant or sampling at the delivered on-site location. Should the parties agree that the independent QAL will collect test samples from delivered products, i.e., on-site sampling, the following sampling and testing criteria apply:

a. Conformance testing shall be performed by an independent Quality Assurance Laboratory (QAL) [previously approved by the Site CQA Engineer] at a minimum of one (1) per one hundred thousand (100,000) ft^2 of each type of HDPE FML material delivered to the site; or one (1) sample per lot, whichever results in the greater number of conformance tests. As stated in the Project Technical Specifications, the Site CQA Manager or Installer shall obtain the samples from the HDPE FML roll, mark the machine direction, lot number and roll number. The minimum number of conformance samples shall meet the requirements outlined in ASTM D 4354. The following conformance tests shall be conducted at the QAL:
   - Thickness (ASTM D 5994)
   - Density (ASTM D 1505/0792)
   - Tensile properties (ASTM D 6693)
   - Tear resistance (ASTM D 1004)
   - Carbon black content (ASTM D 4218)
   - Carbon black dispersion (ASTM D 5596)
   - Puncture resistance (ASTM D 4833)

b. These conformance tests shall be performed in accordance with **Tables II.7.5**.

c. All conformance test results shall be reviewed by the Site CQA Manager and Site CQA Engineer; and all lots shall be accepted or rejected, prior to the placement of the HDPE FML. All test results shall meet, or exceed, the property values listed in **Table II.7.5** (textured HDPE FML). In case of failing test results for any individual lot sample, the lot shall be resampled and retested. This retesting shall be at the expense of the Installer or the Manufacturer. If all of the test values from the resamples pass the acceptable certified values listed in **Table II.7.5,** 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) The method used to unroll the panels shall neither score, scratch or crimp the geomembrane, nor damage the underlying liner system components or subgrade.
m) 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.
n) 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.
o) 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.
p) 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.
q) 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.
r) 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.
s) 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 and no horizontal seams shall be located within 5 feet of the sideslope toe.

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 one (1) hour 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 one 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 pelletized 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.

c) 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 at least 5 minutes.

(6) If loss of pressure exceeds 1% ±, 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.

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 SDR 13.5 HDPE leachate collection pipe onto the bedding layer will be performed in accordance with the Leachate Pipe Specifications.
   b. Installation of the SDR 13.5 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 is the preferred material 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 13.5 as shown on the Engineering Drawings. The Construction Plans and Technical Secifications for each unit may specify a different SDR wall thickness (e.g., SDR 11, SDR 17, etc.).

b) Solid wall 12-inch diameter HDPE Driscopipe as manufactured by Phillips 66, or approved equal, with a standard dimension ratio (SDR) of 13.5 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 13.5 as shown on the Engineering Drawings.
d) HDPE pipe shall meet the requirements of cell classification PE 445574C 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 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.

11.4 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.

11.5 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.

11.6 Installation

11.6.1 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. High Density Polyethylene (HDPE) Leachate Collection Pipe Installation
      1) Installation of the 6-inch diameter perforated SDR 13.5 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.

11.6.2 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. High Density Polyethylene (HDPE) Leachate Collection and Leak Detection Pipe Installation
      1) Installation of the 12-inch or 4-inch diameter SDR 13.5 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
OWL Landfill Services, LLC

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 **Standard = __ 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 _____ **Standard = __/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	OCD	Project	OCD

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

with Geotextile:
upper _____ lower _____

collected by _____
performed by _____
frequency _____
total number _____

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 collected by _____
Specifications: performed by _____
greater than frequency _____
smaller than total number _____

4.3 Geotextile

Specifications: oz collected by _____
Woven or Nonwoven performed by _____
frequency _____
Area: _____ Acres or ft^2 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 performed by _____
frequency _____
Thickness (inches): _____ total number _____

Volume _____ yd^3

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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

GORDON ENVIRONMENTAL, INC.

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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								
7								
8								
9								
10								
11								
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REVIEWED BY: _____ **DATE:** _____

GORDON ENVIRONMENTAL, INC.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

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								
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REVIEWED BY: _____ **DATE:** _____

GORDON ENVIRONMENTAL, INC.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

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			
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REVIEWED BY: _____ **DATE:** _____

GORDON ENVIRONMENTAL, INC.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

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			
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GORDON ENVIRONMENTAL, INC.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

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			
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GORDON ENVIRONMENTAL, INC.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

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:** ________________

GORDON ENVIRONMENTAL, INC.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

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:** ____________

GORDON ENVIRONMENTAL, INC.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

ATTACHMENT II.7.L

FML TRIAL SEAMING TEST LOG

FML TRIAL SEAMING TEST LOG

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	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					
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REVIEWED BY: ______________________ **DATE:** ______________________

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

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										
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REVIEWED BY: _____ **DATE:** _____

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

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									
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REVIEWED BY: _____ **DATE:** _____

GORDON ENVIRONMENTAL, INC.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS
SECTION 7: LINER CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

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	
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REVIEWED BY: ________________________ **DATE:** ________________

GORDON ENVIRONMENTAL, INC.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

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								
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REVIEWED BY: _____ **DATE:** _____

GORDON ENVIRONMENTAL, INC.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

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
OWL LANDFILL SERVICES, LLC

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
OWL LANDFILL SERVICES, LLC

VOLUME II: LANDFILL MANAGEMENT PLANS
SECTION 8: LEACHATE MANAGEMENT PLAN

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APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: LANDFILL MANAGEMENT PLANS
SECTION 8: LEACHATE MANAGEMENT PLAN

1.0 INTRODUCTION

OWL Landfill Services, LLC (OWL) is proposing to permit, construct, and operate a "Surface Waste Management Facility" for oil field waste processing and disposal services. The proposed OWL Facility is subject to regulation under the New Mexico (NM) Oil and Gas Rules, specifically 19.15.36 NMAC, administered by the Oil Conservation Division (OCD). The Facility has been designed in compliance with the requirements of 19.15.36 NMAC, and will be constructed, operated, and closed in compliance with a Surface Waste Management Facility Permit issued by the OCD.

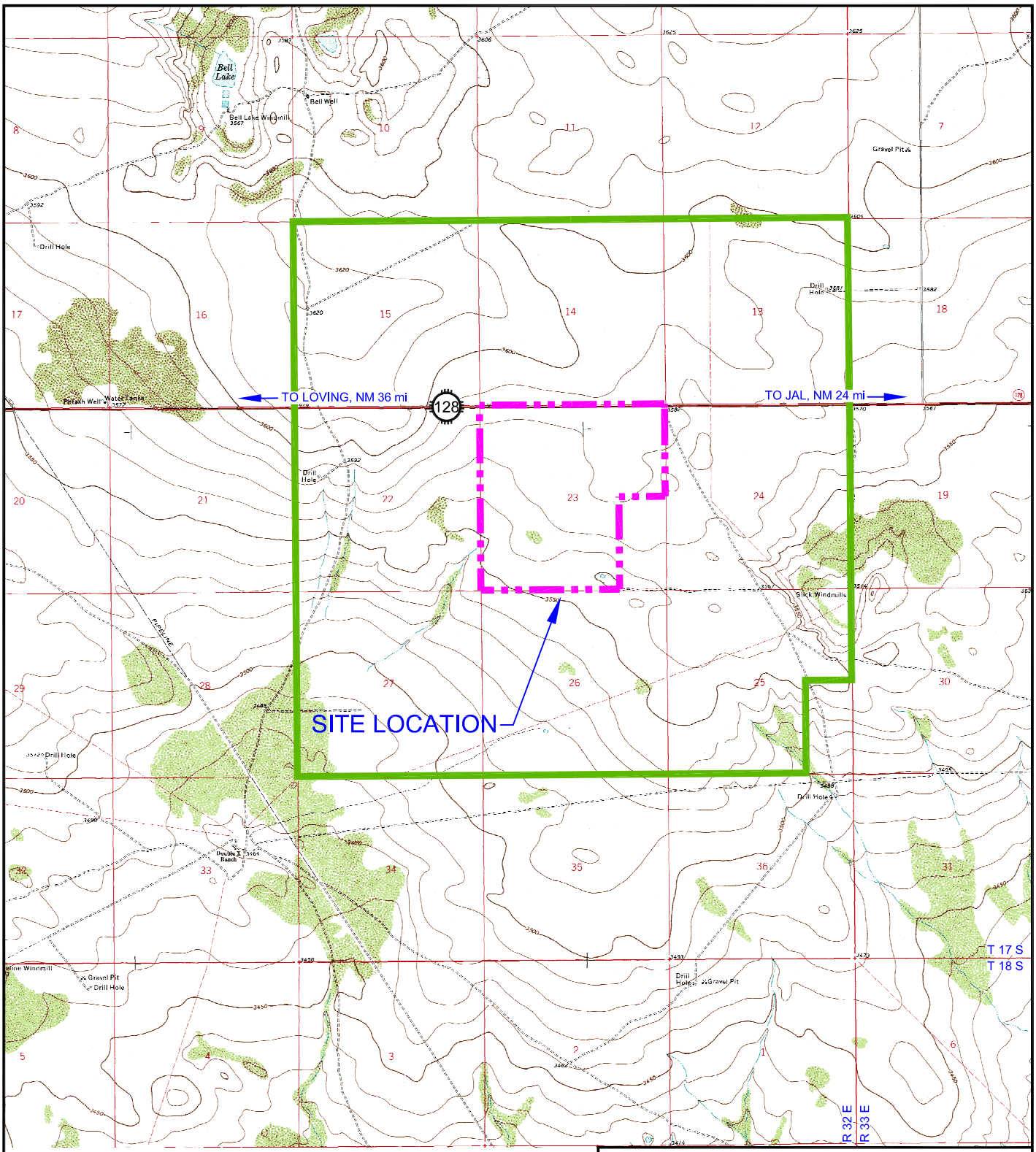
The OWL Facility is one of the first designed to the new more stringent standards that, for instance, mandate double liners and leak detection for land disposal. The new services that OWL will provide fill a necessary void in the market for technologies that exceed current OCD requirements.

1.1 Site Location

The OWL site is located approximately 22 miles northwest of Jal, adjacent to the south of NM 128 in Lea County, NM. The OWL site is comprised of a 560-acre ± tract of land located within a portion of Section 23, Township 24 South, Range 33 East, Lea County, NM (**Figure II.8.1**). Site access will be provided on the south side of NM 128. The coordinates for the approximate center of the OWL site are Latitude 32.203105577 and Longitude -103.543122319 (surface coordinates).

1.2 Description

The OWL Surface Waste Management Facility will comprise approximately 500 acres of the 560-acre site, and will include two main components: an oil field waste Processing Area and an oil field waste Landfill, as well as related infrastructure. Oil field wastes are anticipated



LEGEND

SITE BOUNDARY

1 MILE OFFSET FROM SITE

NOTES:

1) SITE IS LOCATED WITHIN A PORTION OF SECTION 23, TOWNSHIP 24 SOUTH RANGE 23 EAST, LEA COUNTY, NEW MEXICO

2) MAP REFERENCE:
BELL LAKE, NM. 1973 USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP

NORTH

0 2000' 4000'

Drawing:P:\acad 2003\560.01.02\PERMIT FIGURES\SITE LOCATION.dwg
Date/Time:Sep. 20, 2016-08:11:54 ; LAYOUT: A (P)

SITE LOCATION MAP

OWL LANDFILL SERVICES, LLC
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: 09/20/2016	CAD: SITE LOCATION.dwg	PROJECT #: 560.01.02
DRAWN BY: DMI	REVIEWED BY: DRT	FIGURE II.8.1
APPROVED BY: IKG	gei@gordonenvironmental.com	

to be delivered to the OWL Facility from oil and gas exploration and production operations in southeastern NM and west Texas. The **Permit Plans** (**Attachment III.1.A**) identify the locations of the Processing Area and Landfill facilities.

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 OWL 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 OWL 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. Standard dimension ration (SDR) 13.5, (or as otherwise specified in the Construction Plans and Technical Specifications for each Unit) high density polyethylene (HDPE) piping is demonstrated to meet the site-specific performance standards.
4. The protective soil layer (minimum 24 inches of pervious soil) with 4.2×10^{-5} cm/sec 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/GCL 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 OWL 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.

In addition, each of the seven cells will be equipped with a permanent solid pipe riser at the upgradient terminus for leachate piping cleanout.

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.7**)

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 fluid accumulation on the liner is designed to maintain leachate “head” well below the performance standard of 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. OWL will maintain a record of actual leachate generation and management volumes, using a form similar to the one provided as **Attachment II.8.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 and dry nature of the waste and the paint filter restriction. Therefore, most leachate generation is attributable solely to precipitation; and particularly fluids from precipitation in the very early stages of cell development immediately following liner installation.

The leachate generation rate decreases to nearly zero following the placement of the first lift of waste on the liner. This assumption 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 are not generated and thus 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 ("fluff") 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 primary liner leachate collection sumps and leak detection sumps will ensure that the fluid accumulation on the liner will be maintained well below the regulatory 12-inch threshold measured from the liner at the top of the edge of the sump. 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.8.A** is a template for monitoring levels and extraction data, as well as the disposal technique used.

5.0 LEACHATE DISPOSAL

OWL is requesting approval to recirculate leachate over lined areas of the landfill during the active life of the OWL Facility. The following procedures will be adhered to when performing recirculation of leachate at OWL:

- On an as-needed basis (initially anticipated to be quarterly), leachate will be pumped from the sump(s) with a portable or permanent 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.8.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. OWL 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 and temporary roadways over lined areas
- disposal offsite at an OCD-approved facility

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 with the routine waste processing stream.

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 lined cell areas only or future areas to be lined and yet to be excavated.
- 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. No ponding will be allowed.
- To enhance safety, leachate will be sprayed only when personnel are restricted from 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 OCD-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 an OCD-approved

facility. 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. Leachate production following closure is calculated to approach zero.

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 monthly basis; and documented on the Leachate Monitoring Form (**Attachment II.8.A**), or the Pond Integrity/Leak Detection Inspection Form (**Attachment II.8.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 in the leak detection system due to condensation and nominal flow through the primary liner. The leak detection 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.8.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.8.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, and a rigorous proposed CQA Plan (**Volume II.7**) this is an extremely conservative analysis for the Landfill.

The liquid levels in the leak detection sumps will be monitored at least monthly 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 quarterly; and semi-annual or annual thereafter. In the event and excessive liquid level (i.e., > corrective action level) 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 and submittal of results of OCD
- Enhanced vadose zone monitoring (as 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 and submittal of results to OCD
- 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.

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: LANDFILL MANAGEMENT PLANS
SECTION 8: LEACHATE MANAGEMENT PLAN

ATTACHMENT II.8.A

LEACHATE MONITORING FORM (TYPICAL)

ATTACHMENT II.8.A
Leachate Monitoring Form (Typical)
OWL Landfill Services, LLC

Leachate Level Data				Pumping Data			Notes
Date	Sump I.D.	Time	Monitored By	Date	Company	Volume Pumped (gal)	

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: LANDFILL MANAGEMENT PLANS
SECTION 8: LEACHATE MANAGEMENT PLAN

ATTACHMENT II.8.B

POND INTEGRITY/LEAK DETECTION INSPECTION FORM (TYPICAL)

ATTACHMENT II.8.B
Pond Integrity/Leak Detection Inspection Form (Typical)
OWL Landfill Services, LLC

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
OWL LANDFILL SERVICES, LLC

VOLUME II: LANDFILL MANAGEMENT PLANS
SECTION 8: LEACHATE MANAGEMENT PLAN

ATTACHMENT II.8.C

POTENTIAL GEOMEMBRANE LINER LEAKAGE

Attachment II.8.C
Potential Geomembrane Liner Leakage
OWL Landfill Services, LLC

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

MONITORING PLAN

APPLICATION FOR PERMIT
OWL LANDFILL SERVICES, LLC

VOLUME II: FACILITY MANAGEMENT PLANS

SECTION 9: VADOSE ZONE MONITORING PLAN

VADOSE ZONE MONITORING PLAN
FOR THE
PROPOSED OWL LANDFILL SERVICES, LLC
SURFACE WASTE MANAGEMENT FACILITY

LEA COUNTY, NEW MEXICO

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September 30, 2016 **1530841**

Golder Associates

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1.0 INTRODUCTION

The OWL Landfill Services, LLC (OWL) site is located in southwestern Lea County, New Mexico. The site is a roughly 560-acre tract located in Section 23, T. 24 South, Range 33 East. The OWL Surface Waste Management Facility will comprise approximately 500 acres of the 560-acre site, and will include two main components: an oil field waste Processing Area and an oil field waste Landfill, as well as related infrastructure. A permit for a surface waste management facility for oil and gas waste is sought under provisions set forth in 19.15.36 New Mexico Administrative Code (NMAC) (i.e., "Part 36"). Part 36 provisions (i.e., 19.15.36.13.A(1) and (5) NMAC), require that no landfill will be located where groundwater is less than 100 feet below the lowest elevation of the design depth at which oilfield waste will be placed, and no other surface waste management facility shall be located where groundwater is less than 50 feet below the placement of oilfield waste. 19.15.36.14(B) NMAC includes requirements for groundwater monitoring at facilities where "fresh groundwater" exists, unless "otherwise approved by the division." Fresh groundwater, per 19.15.2.7.F(3) NMAC, is defined as groundwater that contains less than 10,000 milligrams per liter of total dissolved solids.

The OWL site is located in an area where few shallow groundwater resources are known to exist. Information obtained from several borings that were advanced on the tract provide adequate demonstration that the minimum depth to the shallowest groundwater bearing zone on the property exceeds 160 feet below land surface and is more than 100 feet below projected landfill base grade levels.

Depth to water-bearing zones in the Santa Rosa Sandstone, which is the shallowest groundwater aquifer in the vicinity of the site, is projected to occur at approximately 393 feet beneath land surface near the center of the proposed facility and 341 feet below the proposed base grade near the center of the site**.** Water-bearing zones at the site are vertically separated from proposed waste cells at the facility by approximately 341 feet of dense non water-bearing Chinle Shale deposits. Projected depths to formation intercepts, top of the water-bearing zone in the Santa Rosa Sandstone, and water level at the OWL site are summarized as follows:

Site Hydrogeologic Feature	*Projected Depth Below Land Surface (ft)	*Depth Below Waste Cell Base Grade (ft)
Top of Chinle Shale	42	0
Top of Santa Rosa Sandstone	375	333
Top of Water-Bearing Zone in Santa Rosa Sandstone	≥393	341
Top of Potentiometric Surface of Santa Rosa Sandstone	393	341

Notes: *Projected at the center of the proposed waste management area

The proposed facility design includes double high-density polyethylene (HDPE) lining of waste cells with an intervening leak detection layer, as well as installation of equipment and operational provisions for leachate monitoring and collection. Based upon shallow stratigraphy in the vicinity of the proposed facility, it is anticipated that, in the unlikely event that leakage were to occur, the fluid would migrate vertically through unconsolidated alluvium and would pool on the upper surface of laterally extensive dense shale redbeds that are present at depths ranging from approximately 25 feet below land surface in the northwest corner of the site to approximately 55 feet below land surface in the south central portion of the site. Available subsurface stratigraphic information for the site and surrounding area indicates that potential leakage would migrate down-slope above the alluvium-shale interface and perhaps in the upper few feet of weathered shale bedrock to the south. Additionally, facility design calls for disposal cells (and in particular sumps) to be excavated into the Chinle Shale such that a closed basin will be created in the upper surface of the shale on the southern and downgradient side of the disposal facility.

Inasmuch as the proposed facility design includes double HDPE lined waste cells and provisions for leachate monitoring and 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 for the site. Due to the significant depth to groundwater at the site, as well as the low hydraulic conductance and thickness of shale bedrock above water-bearing zones in the Santa Rosa Sandstone beneath the site, it is anticipated that properly positioned and completed vadose zone monitoring wells would detect leakage from the facility long before groundwater monitoring wells completed in the Santa Rosa Sandstone could; and thus would provide a greater level of protection to groundwater resources at the facility.

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

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

Physiography of the vicinity of the OWL site in southern Lea County and eastern Eddy County was described by Nicholson and Clebsch (1961) and Kelly (1979); and is summarized in the physiographic map provided as **Figure II.9.1**. The site is situated in Landreth-Monument Draw watershed (USGS cataloging Unit 13070007) near the eastern boundary of the Lower Pecos-Red Bluff Reservoir watershed (USGS cataloging unit 13070001).

The OWL site is located on a broad, northwest-to-southeast trending salient known as Antelope Ridge in the area between the High Plains (alternately, the Llano Estacado) to the northeast and the Pecos River to the southwest. Antelope Ridge is the southernmost of two broad northwest-to-southeast trending salients in southwestern Lea County; the northern salient is known as Grama Ridge. These salients are generally erosional remnants 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 Formation in much of southeastern New Mexico. In the vicinity of Grama Ridge and Antelope Ridge, the Ogallala has been largely removed by erosion and a veneer (generally less than 100 feet) of Quaternary age unconsolidated Ogallala detritus and aeolian sands mantle shale and sandstone beds of the Triassic Chinle. Salients are formed by resistant well-cemented sections (caliche) of the Ogallala Formation where ledge-forming units remain.

The location of the OWL site, as well as Antelope Ridge, are shown in the surficial geologic map in **Figure II.9.2.** Shallow subsurface geologic units at the OWL site include approximately 20-60 feet of unconsolidated Quaternary sand, silt, gravel, and caliche above Triassic shale bedrock of the Chinle Formation (redbeds).

3.0 GROUNDWATER OCCURRENCE AND SITE CONDITIONS

Water-bearing geologic units in the vicinity of the OWL site include local shallow Quaternary alluvial aquifers and the Santa Rosa Sandstone, which is in the lower portion of the Triassic Chinle shale. In the vicinity of the site, thin laterally discontinuous and ephemeral groundwater saturations are occasionally present in the basal alluvium overlying the Chinle shale. The Santa Rosa Sandstone is present at depth throughout much of southern Lea County and this unit locally produces modest quantities of groundwater.

Configuration of the top of the Chinle shale (i.e., redbeds) is an important control on water availability in alluvial aquifers in the area. The Chinle shale redbeds were exposed and dissected by erosion throughout the region prior to deposition of the alluvium. Shallow groundwater in the vicinity of the site is 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 as an important control on shallow groundwater availability was recognized by Nicholson and Clebsch; and they utilized Chinle Shale formation top data 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). Shallow stratigraphic units, including basal alluvium and upper Chinle shale, have been investigated extensively in the immediate vicinity of the OWL site. Five site characterization borings fully penetrating basal alluvium and as much as 165 feet into the Chinle Shale have been advanced at the OWL site. Additionally, Intercontinental Potash Corporation (ICP) has drilled 25 borings in the vicinity of the OWL site pursuant to completion of a geotechnical site study for the proposed Ochoa Potash Mine; and each of these borings penetrated at least to the top of the Chinle Shale. Based upon the number of site characterization borings at the OWL and adjacent Ochoa Mine sites, we conclude that no additional site characterization drilling is required; however, we propose to integrate boring data obtained during proposed vadose zone monitoring well installation into site characterization data for the OWL site.

Locations of site characterization borings and wells in the vicinity of the OWL site are shown on **Figure II.9.3.** The geometry of land surface and underlying geologic units, as well as groundwater saturations in the vicinity of the OWL site, are depicted in the hydrogeologic cross section shown in **Figure II.9.4**. **Figure II.9.4** indicates that the shallowest water-bearing zone is the Santa Rosa Sandstone (lower Triassic Chinle), which is approximately 375 feet below land surface at the OWL site.

Table II.9.1 contains a summary of information from site characterization borings, water wells, oil wells, and/or other borings in the vicinity of the OWL site. Data included in **Table II.9.1** were obtained from the following sources:

- Logs from geotechnical borings at the OWL tract (**Attachment II.9.A**)
- Well and water level data from consultant reports; Geohydrology Associates Inc. (1978), Shomaker (2014), Intera (2013)
- Water well data from Nicholson and Clebsch (1961)
- New Mexico Office of the State Engineer (NMOSE) Well Records (**Attachment II.9.B**)
- Summary oil well data on shallow stratigraphy taken from New Mexico Oil Conservation Division records

Wells and borings in the vicinity of the OWL site that yielded data of significance with regard to groundwater occurrence or potential are plotted on the well location map in **Figure II.9.3**. Few water wells are present in the vicinity of the OWL site. Soil borings advanced on the OWL tract found dry alluvium on top of the redbeds and no saturation in approximately the upper 100 feet of the redbeds at the site. Copies of the logs from these borings are included in **Attachment II.9.A**.

A few shallow alluvial wells are present in the vicinity of the site, including a stock well (well 24.23.24.444) completed in alluvial fill and located approximately one mile east of the site. Other alluvial fill wells are located near Bell Lake, approximately 2 ¾ miles northwest of the site and in an unnamed depression feature located approximately 2 ¼ miles southwest of the site. One of the OWL site borings (BH2) penetrated a thin saturation of non-sustainable groundwater in the lowermost few inches of alluvium on top of the Chinle Shale approximately 1400 feet from the southeast corner of the waste management footprint.

Several wells in the vicinity of the OWL site produce water from water-bearing zones in the Santa Rosa Sandstone. One of these wells is located on the OWL site (McCloy Well, Well CP-3662). According to the NMOSE log for this well, water was detected in a sandstone interval between 250 and 275 feet below grade; however, the well was advanced to a depth of 550 feet and completed with screened intervals from 280 feet to 360 feet and from 500 feet to 550 feet below grade and annular pea gravel pack from total depth to 20 feet below grade. The well record indicates that the water level in the well upon completion (8/19/13) was 110 feet below grade. A water level recorded during pump installation (8/24/13), indicated that the water level was 393 feet below grade. Based upon this information, it is concluded that zones having sustained low yield to this well are below 393 feet.

A regional projection of the top of the Santa Rosa Sandstone is shown in **Figure II.9.5.** A regional projection of the potentiometric surface of water levels from wells completed in Triassic bedrock units is shown in **Figure II.9.6**. These maps indicate that the top of the Santa Rosa Sandstone is projected at an elevation of 3200 feet above Mean Sea Level (msl), and the potentiometric surface is projected at an elevation of 3189 feet above msl at the OWL site.

Other vicinity wells that are completed in the Santa Rosa Sandstone or in other Triassic bedrock aquifers include a group of three wells (C-2430, C-2431, C-2432), located approximately two miles west of the site in Sections 16 and 17 of Township 24 South and Range 33 East. Another well (C-3666), located approximately one mile northeast of the site in Section 13 of Township 24 South and Range 33 East, is completed in the Santa Rosa Sandstone. A well that was present at the OWL site (24.33.23.311) was apparently completed in Triassic bedrock. Water level and total depth measurements were made on this in November 1953 and indicated that the total depth was 232 feet below land surface (bls) and the water level was 208.6 feet bls. The well was not equipped and was not in use at that time (Nicholson and Clebsch, 1961). The well was cited by Geohydrology Associates Inc. (1978) and was listed as abandoned. The well was inspected by Golder Associates Inc. personnel in June 2015 and was observed to have been out of use for many years and caved to approximately 8 feet below grade.

4.0 CHINLE SHALE AQUICLUDE

The vicinity of the OWL site is underlain by thick and laterally extensive deposits of Chinle Shale. Water-bearing zones within the Santa Rosa Sandstone are projected to be more than three hundred feet below the top of the Chinle Shale at the OWL site. A summary of geotechnical testing data performed on soil borings at the OWL site is presented in **Table II.9.2**. A sample of Chinle Shale was collected from a depth of 100 feet below grade in OWL Boring BH1 and was tested, yielding a permeability value of 2.87×10^{-8} centimeters per second (cm/sec). Another sample of Chinle Shale was collected from a depth of 45 feet below grade in OWL Boring BH4 and tested, yielding a permeability value of 4.56×10^{-7} cm/sec. The test results of these samples, collected as loose drill cuttings and tested with a remolded permeability method, are expected to be higher (i.e., more impermeable) than those present insitu within the formation.

A projection of the upper surface of the Chinle Shale developed using data from borings at the OWL site, as well as information from other wells and borings on adjacent tracts, is presented in **Figure II.9.7**. The excavation envelope for the proposed OWL facility is superimposed onto the projected Chinle Shale surface, showing that the excavation for disposal cells at the OWL facility will penetrate through the basal alluvium and into the top of the Chinle in much of the southern portion of the projected limits of waste. The design base grades will penetrate as much as 30 feet into the projected Chinle Shale in the southwestern and southeastern corners of the proposed excavation, such that a closed depression will be excavated into the shale in the southern extent of the excavation. Geometries of land surface, the Chinle Shale surface, and the projected facility excavation are depicted on the vadose zone cross section in **Figure II.9.8**.

5.0 PROPOSED VADOSE ZONE MONITORING NETWORK

Due to the anticipated significant depth to the shallowest water-bearing units in the Santa Rosa Sandstone, as well as high impedance to vertical water flow posed by the Triassic redbeds at the OWL facility, vadose zone monitoring is proposed for the site. The proposed vadose zone monitoring network wells would be positioned along the southern boundary of the disposal cells immediately downslope on the mapped upper redbed surface to the south of the facility and screened across the Chinle Shale and alluvium interface, where fluid from a potential leak from the facility would be detected before approaching water-bearing zones in the Santa Rosa Sandstone, more than 300 feet below.

5.1 Proposed Monitoring Well Locations

Locations of the proposed vadose zone monitoring wells for the facility are shown on the map in **Figure II.9.7.** Five wells are proposed along the southern boundaries of the facility disposal cells and materials processing facilities, three of which are positioned directly downgradient from leachate collecting sumps, which are the lowest point in the liner system. Based upon the projection of the Chinle shale structure, there is a high confidence level that proposed vadose zone monitoring wells positioned directly downslope from the proposed waste disposal cells and processing areas will provide the best available opportunity for early detection of fugitive fluids in the unlikely event of a release.

5.2 Proposed Well Drilling and Completion

It is proposed that the existing site characterization dataset be augmented with emergent stratigraphic and hydrogeologic information that would be obtained during drilling for the proposed vadose zone wells. Prior to drilling, each proposed well location will be surveyed and staked, and elevation of land surface determined such that precise elevations of stratigraphic intercepts can be determined in real time during drilling. The site geologist or engineer will determine the elevation of the top of the Chinle Shale surface; and the top of the Chinle Shale projection map will be revised as necessary to comport with the new data. During well installation, lithologic logs and the revised top of shale surface will be iteratively provided to New Mexico Oil Conservation Division (NMOCD) personnel such that the new data may be used to optimize the locations and/or completions of the vadose zone monitoring wells.

Proposed vadose zone monitoring wells would be installed using hollow-stem auger drilling methods; i.e., no fluids would be introduced into the borings during drilling. Drilling equipment would be equipped to switch to air rotary should auger refusal be reached before adequate depth is reached for each well. Undisturbed, depth-referenced samples would be collected on five-foot intervals using split spoon sampling equipment. Drive blow counts would be logged during each sampling event and used to allow precise determination of the upper indurated redbed surface in each hole. A competent hydrogeologist or engineer would be present on location during drilling and would prepare detailed descriptions of the

lithology, texture, sorting, rounding, color, plasticity, degree of lithification, and moisture content of each sample and stratigraphic unit that is penetrated.

Each boring would be advanced into indurated Triassic redbeds to an adequate depth to reach an elevation of approximately 3490 feet above msl, or to a depth of approximately ten feet lower than the deepest penetration of the adjacent waste cell base grades. 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 would be placed on standby for at least two hours, during which time soundings will be made inside the augers to check for accumulating fluid.

Vadose zone monitoring wells will be completed in accordance with the specifications set forth on the well design sheet in **Figure II.9.9**. Each well will be completed using 2-inch schedule 40 flush joint casing. Each well will be completed with a 30-foot length of 0.010-inch slotted well screen, positioned with the lowermost end extending below the upper redbed surface to a depth adequate to reach an elevation of 3490 feet above msl, or to a depth of ten feet lower than the deepest penetration of waste cell base grades, expected to be 3500 feet above msl. Well screens would span the vertical distance from approximately ten feet above the Chinle Shale and alluvium interface to total well depth, or approximately twenty feet into the shale. Each well annulus will be backfilled with a 10/20 grade silica sand pack extending two feet above the screen and an annular seal consisting of bentonite grout or equivalent extending to 3 feet below land surface. The remainder of the annulus to land surface will be filled with concrete. Each well would be equipped with a radially sloped concrete surface pad with locking steel shroud extending approximately 3 feet above grade. Specific proposed well geometries and construction materials are summarized in **Table II.9.3** below:

Table II.9.3
Vadose Zone Monitoring Well Installation Specifications
OWL Landfill Services, LLC

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 20 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 2-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 30-ft length of 0.010-in slotted well screen. The well screen will be positioned with the lowermost portion extending approximately 20 ft below the detected upper redbed surface and the upper portion extending approximately 10 ft into the overlying alluvium. Casing centralizers will be placed at the top and bottom of the screened interval as shown on **Figure II.9.9**.

The remaining well casing will be constructed with blank 2-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 professional 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 NMOCD in a “Well Completion Report.”

6.0 PROPOSED VADOSE ZONE MONITORING PROGRAM

The proposed vadose zone monitoring program would initially include monthly inspection of each well for the presence of fluid as with leak detection sumps in accordance with provisions set forth in 19.15.36.13.L(1) NMAC. Results of fluid detection measurements would be submitted with related leachate monitoring results in normal facility operations reporting to the division. If fluids are noted in any of the monitoring wells, the fluid will be sampled and tested quarterly in accordance with 19.15.30.9 and 20.6.2.7 NMAC; and a reporting of findings will be transmitted to the division in accordance with requirements for groundwater monitoring and reporting set forth in 19.15.14.B NMAC.

Evidence of fluids in the vadose zone monitoring wells 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 OWL facility vadose zone monitoring network.

6.1 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 well 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 wells may be the subject of future specific approvals by NMOCD for a reduced monitoring frequency (i.e., semi-annual or annual).

6.2 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.9.C** 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.9.4**. 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. These data will be considered “background values.”

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 evident.

6.3 Monitoring Data Evaluation

If the field parameter measurements indicate that a well shows evidence of non-natural constituents, NMOCD will be notified within 48 hours and verification re-sampling (VRS) for the parameters listed in **Table II.9.4** 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.9.4** 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 OWL facility will work with NMOCD to devise an appropriate scope of work for assessing water quality changes.

If the comparative evaluation indicates that the well may contain non-naturally occurring fluids, the OWL facility will submit an Action Plan to NMOCD 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.9.4
Vadose Zone Monitoring Parameters
OWL Landfill Services, LLC

Field Parameters	
Specific Conductance	Temperature
pH	Depth to Water
Total Well Depth	
Major Cations	
Calcium	Iron
Magnesium	Potassium
Sodium	
Major Anions	
Fluoride	Chloride
Nitrate as N	Phosphorous
Sulfate	
RCRA Metals	
Arsenic	Lead
Barium	Mercury
Cadmium	Selenium
Chromium	Silver
Organic Compounds	
Benzene	Ethylbenzene
Toluene	Xylenes
Additional Parameters	
Total Dissolved Solids (TDS)	Total Petroleum Hydrocarbons (TPH)

Concurrent with each vadose zone monitoring event, soil vapor monitoring will be performed in each active well using an electronic, intrinsically safe portable gas analyzer, or equivalent instrument. Soil vapor samples will be purged from each vadose zone monitoring well and screened for concentrations of hydrogen sulfide. Hydrogen sulfide concentrations will be expressed as percent volume in air; and will be recorded on the form provided as **Attachment II.9.C**. In the event that hydrogen sulfide concentrations approach the OSHA Permissible Exposure Limit (PEL) for construction workers, the OWL facility will work with NMOCD to devise an appropriate scope of work for assessing the hydrogen sulfide monitoring results.

7.0 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.

Intera, 2014, Analytical results for water quality samples collected on behalf of Intercontinental Potash Corp. from wells on the Double M Ranch, Lea County, NM: consultant report to IC Potash Corp.

New Mexico Oil Conservation Division, 2015, Electronic data and well log files for oil and gas wells in the vicinity of the OWL site, http://www.emnrd.state.nm.us/OCD/ocdonline.html.

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.

Shomaker, 2014, Summary of wells in the vicinity of the McCloy Ranch.

TABLES

Table II.9.1 **Records of Wells and Borings in the Vicinity of the OWL Site**
OWL Landfill Services, LLC

NMOSE File No. or Well Name	Borehole, Well ID or API No.	USE	Drill Date	Litho Log	Owner	Water Source	Location PLS Township South Range East	UTM X (NAD 83)	UTM Y (NAD 83)	Land Surf Elevation (ft) Estimated from USGS 7.5' Sheets (NAD-27)	Depth (ft)	Depth to Water (ft)	WL Elevation (ft) above MSL	WL Date (or Completion Date)	Flow Rate (gpm)	Aquifer	Water-Bearing Zone	Depth to Top Tr Chinle (ft)	Elev Top Tr Chinle (ft)	Depth to Top Santa Rosa SS (ft)	Elev. Top Santa Rosa SS (ft)	Depth to Top of Rustler Anhydrite (ft)	Elev. Top of Rustler Anhydrite (ft)	Source of Data Comments
Permitted Carlsbad Underground Basin Water Wells																								
C 03528 POD1		Stock	3/12/2012	X	MARK MCCLOY (M&M RANCH)	Shallow	24.32.15.211	625948	3566099	3594	541	133	3461			Qal-Tr	133-152	75	3519					OSE Well Record
C 02308		Stock	6/30/1920		MCCLOY	Shallow	24.33.10.131	634953	3567364	3592	40	20			15	To/Qal								Shomaker 10/2014; OSE POD Summary
C 03666 POD1			10/26/2013	X	Agave Energy Co	Shallow	24.33.13.432	639132	3565078	3588	650	390	3198		38	Tr	460-600	90	3498					OSE Well Record
C 02430		Comm	12/31/1982		PLAINS FEDERAL LAND BANK ASSOC	Shallow	24.33.16.333	633377	3564732	3573	643	415	3158		12	Tr								Shomaker 10/2014; OSE POD Summary
C 02431		Comm	12/31/1959		PLAINS FEDERAL LAND BANK ASSOC	Shallow	24.33.17.444	633175	3564728	3573	525	415	3158		20	Tr								Shomaker 10/2014; OSE POD Summary
C 02432		Comm	12/31/1980		MCCLOY	Shallow	24.33.17.444	633I75	3564728	3573	640	415	3158		45	Tr								Shomaker 10/2014; OSE POD Summary
C 03662 POD1		Dom-Stk	8/20/2013 8/24/2013	X	MARK MCCLOY (M&M RANCH)	Shallow	24.33.23.213	637342	3564428	3582	550	110 393	3189		10	Tr	250-275	30	3552					OSE Well Record + Pump Set WL
C 02309		Dom-Stk	6/30/1912		PLAINS FEDERAL LAND BANK ASSOC	Shallow	24.33.25.222	639705	3562966	3518	60	30			40	To/Qal								Shomaker 10/2014; OSE POD Summary
C 02310		Comm	12/31/1890		MCCLOY	Shallow	24.33.33.232	634437	3560918	3472	120	70			60	To/Qal								Shomaker 10/2014; OSE POD Summary
C 02311		Dom-Stk	12/31/1890		MCCLOY	Shallow	24.33.33.232	634437	3560918	3472	120	70			60	To/Qal								Shomaker 10/2014; OSE POD Summary
Pre-Basin Water Wells, NMBM GW Report 6, 1961 and Geohydrology Associates, 1978																								
Prebasin Well		Dom-Stk			Brinninstool		23.33.28.334	633586	3571164	3683	575	500	3183		2.5	Tr								NMBM GW Report 6
Prebasin Well		Industrial	1953		Continental Oil		23.34.31.340	640352	3569745	3616	678				47	Tr								NMBM GW Report 6
Prebasin Well		Stock			Frank James		24.32.10.344	625927	3566147	3593	60	31.1	3562	6/3/55		Qal								NMBM GW Report 6
Prebasin Well		Stock					24.32.10.344	625927	3566147	3593	40	34.5	3559	11/18/77										GAI 1978 (NMBM GW Report 6)
Prebasin Well		Dom-Stk			Frank James		24.32.3.322	625775	3568454	3661	550	198.3	3463	10/15/53		Tr								GAI 1978 (NMBM GW Report 6)
Prebasin Well		Stock			Richard Ritz		24.32.33.422	625217	3560349	3501	367	313.4	3188	2/18/58	0.25 gpm	Tr								Nicholson Clebsch 1961
Prebasin Well		Stock					24.32.33.423	625217	3560349	3500	334.2	314.09	3186	11/8/77		Tr								GAI 1978
Prebasin Well		Stock			Carl Johnson		24.33.10.113	634979	3567350	3592	36	24.6	3567	11/27/53		Qal								GAI 1978 (NMBM GW Report 6)
Prebasin Well		Not Used					24.33.23.311	636675	3563632	3559	232	208.6	3350	11/27/53		Tr								GAI 1978 (NMBM GW Report 6)
Prebasin Well		Stock					24.33.24.444	639698	3563114	3519		17.4	3502	11/27/53		To								GAI 1978 (NMBM GW Report 6)
Prebasin Well		Dom-Stk					24.33.33.231	634400	3560918	3472		93.2	3379	3/17/54		Qal								GAI 1978
Prebasin Well		Dom-Stk					24.33.33.233	634383	3560839	3472		93.15	3379	3/17/54		To								GAI 1978
Prebasin Well		Stock			Madera Ranch		24.34.35.122	646843	3561348	3417	258	224	3193	3/29/55		Tr								NMBM GW Report 6
Prebasin Well		Stock					24.34.4.111	642951	3569350	3569		51.3	3518	6/3/55		To								NMBM GW Report 6
Prebasin Well		Abd-Stk					24.34.4.113	642951	3569350	3567	70	51.88	3515	12/8/70		To								GAI 1978 (NMBM GW Report 6)
Prebasin Well		Obs					24.34.4.114	643043	3569358	3567	56	51.86	3515	11/18/77										GAI 1978
Prebasin Well		Industrial					24.34.4.211	644034	3569226	3549	630	342.56	3206	12/8/70		Tr								GAI 1978
Prebasin Well		Stock					24.34.4.333	642913	3567959	3575	78	66.59	3508	4/21/55		To								GAI 1978 (NMBM GW Report 6)
Prebasin Well							24.34.7.222	641243	3567916	3598		72.19	3526	12/8/70		To								GAI 1978
Prebasin Well		Stock			Madera Ranch		24.35.30.341	650019	1561883	3343	140	150	3193											NMBM GW Report 6
Prebasin Well		Dom-Stk			Plains Prod Co		25.33.20.443	633053	3553407	3402		225	3177	11/27/53		Tr								NMBM GW Report 6
Prebasin Well		Stock			Nick Rtz		25.33.31.244	631723	3551210	3408	320	258	3150	7/26/54		Tr								NMBM GW Report 6
Prebasin Well		Stock			Madera Ranch		25.34.1.132	648200	3559326	3389	300+	231	3158	4/15/53		Tr								NMBM GW Report 6
Prebasin Well		Not Used					25.34.15.242	646117	3556178	3335	168	164.9	3170	7/23/54		Tr								NMBM GW Report 6
Prebasin Well							26.34.6.213	641002	6549971	3321	300	141.9	3179	7/23/54		Tr								NMBM GW Report 6
OWL Section 23 Site Borings																								
Borehole 1		Geotech	11/25/2014	X			24.33.23.222	638096	3564656	3584	150	dry		11/25/14				60	3524					Gordon Environmental 2015
Borehole 2		Geotech	11/19/2014	X			24.33.23.434	637723	3563081	3553	200	39	3514	11/19/14		Qal		40	3513					Gordon Environmental 2015
Borehole 3		Geotech	11/25/2014	X			24.33.23.311	636538	3563071	3546	175	dry		11/25/14				38	3508					Gordon Environmental 2015
Borehole 4		Geotech	11/25/2014	X			24.33.23.111	636515	3564633	3588	200	dry		11/25/14				35	3553					Gordon Environmental 2015
Borehole 5		Geotech	11/25/2014	X			24.33.23.233	637326	3563949	3579	165	dry		11/25/14				45	3534					Gordon Environmental 2015
Transwestern Pipeline Facility Environmental Wells																								
TW PL SVE-13		Environ	12/15/1999		Transwestern Pipe	Shallow	24.33.1.42	639266	3568976	3639	99	90.4	3549	12/15/99				34	3605					OSE Well Record
TW PL MW-13		Environ	12/14/1999		Transwestern Pipe	Shallow	24.33.1.42	639266	3568976	3639	90	83.4	3556	12/14/99				34	3605					OSE Well Record

Table II.9.1 **Records of Wells and Borings in the Vicinity of the OWL Site**
OWL Landfill Services, LLC

NMOSE File No. or Well Name	Borehole, Well ID or API No.	USE	Drill Date	Litho Log	Owner	Water Source	Location PLS Township South Range East	UTM X (NAD 83)	UTM Y (NAD 83)	Land Surf Elevation (ft) Estimated from USGS 7.5' Sheets (NAD-27)	Depth (ft)	Depth to Water (ft)	WL Elevation (ft) above MSL	WL Date (or Completion Date)	Flow Rate (gpm)	Aquifer	Water-Bearing Zone	Depth to Top Tr Chinle (ft)	Elev Top Tr Chinle (ft)	Depth to Top Santa Rosa SS (ft)	Elev. Top Santa Rosa SS (ft)	Depth to Top of Rustler Anhydrite (ft)	Elev. Top of Rustler Anhydrite (ft)	Source of Data Comments
Double M Ranch Wells Included in Water Quality Investigation (Intera, 2013)																								
ICP-DHR-01	East	Stock			McCloy		24.33.17.444	633252	3564318	3573	540					Tr								Intera 5/2013
ICP-DHR-02	Tower	Stock			McCloy		24.33.17.444	633219.4	3564695	3573	unk													Intera 5/2013
ICP-DHR-03	North	Stock			McCloy		24.33.17.444	633278.6	3564685	3571	unk				26.3									Intera 5/2013
ICP-DHR-04	North XX	Stock			McCloy		24.33.17.444	633278.6	3454678	3571	unk													Intera 5/2013
ICP-DHR-05	House WM	Stock			McCloy		24.33.33.232	634398.6	3560920.9	3472	180				24.4									Intera 5/2013
ICP-DHR-06	South XX	Stock			McCloy		24.33.31.433	630409.4	3559829.5	3509	180				3.6									Intera 5/2013
ICP-DHR-07	Unknown	Stock			McCloy		24.34.32.141	641951	3560925	3454	540					Tr								Intera 5/2013
ICP-DHR-08	E House	Stock			McCloy		24.33.33.232	634401	3560929	3472	unk				28									Intera 5/2013
ICP-DHR-09	House	Domestic			McCloy		24.33.33.232	634401	3560834	3472	unk				13.3									Intera 5/2013
ICP-DHR-10	James East	Stock			McCloy		24.32.12.131	628576	3567331	3600	540					Tr								Intera 5/2013
Intecontinental Potash Ore Characterization Borings																								
C03565 POD1	ICP-083	Geotech			Intercontinental Potash Corp		24.33.6.42	630871	3568316	3633														OSE Waters Database POD Summary
C03565 POD2	ICP-084	Geotech			Intercontinental Potash Corp		24.33.7.43	631156	3566515	3581														OSE Waters Database POD Summary
C03565 POD4	ICP-086	Geotech			Intercontinental Potash Corp		24.33.9.14	633672	3567057	3611														OSE Waters Database POD Summary
C03565 POD5	ICP-087	Geotech			Intercontinental Potash Corp		24.33.9.43	634135	3566496	3610														OSE Waters Database POD Summary
C03565 POD6	ICP-089	Geotech			Intercontinental Potash Corp		24.33.10.33	635022	3566373	3617														OSE Waters Database POD Summary
C03565 POD7	ICP-090	Geotech			Intercontinental Potash Corp		24.33.6.22	631361	3569250	3650														OSE Waters Database POD Summary
C 03565 POD3	ICP-085	Geotech	10/21/2012	X	Intercontinental Potash Corp		24.33.8.433	632763	3566546	3601	1533	dry						55	3546			1227	2374	OSE Well Record
C 03565 POD8	ICP-092	Geotech	3/25/2013	X	Intercontinental Potash Corp		24.33.15.14	635485	3565610	3624	1665	dry						55	3569			1284	2340	OSE Well Record
C 03565 POD9	ICP-093	Geotech	2/19/2013	X	Intercontinental Potash Corp		24.33.15.44	636430	3565005	3599	1563	dry						55	3544			1238	2361	OSE Well Record

Table II.9.1 **Records of Wells and Borings in the Vicinity of the OWL Site**
OWL Landfill Services, LLC

NMOSE File No. or Well Name	Borehole, Well ID or API No.	USE	Drill Date	Litho Log	Owner	Water Source	Location PLS Township South Range East	UTM X (NAD 83)	UTM Y (NAD 83)	Land Surf Elevation (ft) Estimated from USGS 7.5' Sheets (NAD-27)	Depth (ft)	Depth to Water (ft)	WL Elevation (ft) above MSL	WL Date (or Completion Date)	Flow Rate (gpm)	Aquifer	Water-Bearing Zone	Depth to Top Tr Chinle (ft)	Elev Top Tr Chinle (ft)	Depth to Top Santa Rosa SS (ft)	Elev. Top Santa Rosa SS (ft)	Depth to Top of Rustler Anhydrite (ft)	Elev. Top of Rustler Anhydrite (ft)	Source of Data Comments
Intecontinental Potash Geotechnical Borings																								
C 03600 POD1	BH-16	Geotech	1/7/2013	X	Intercontinental Potash Corp	Shallow	24.33.26.122	637275	3563023	3553	75	dry						37	3516					Shomaker 10/2014; OSE Well Record
C 03600 POD3	BH-19	Geotech	1/16/2013	X	Intercontinental Potash Corp	Shallow	24.33.26.243	637784	3562340	3551	75	dry						28	3523					Shomaker 10/2014; OSE Well Record
C 03600 POD4	BH-20	Geotech	1/8/2013	X	Intercontinental Potash Corp	Shallow	24.33.26.133	636617	3562293	3522	75	dry						63	3459					Shomaker 10/2014; OSE Well Record
C 03600 POD6	BH-22	Geotech	1/9/2013	X	Intercontinental Potash Corp	Shallow	24.33.26.413	637382	3562026	3532	75	dry						42	3490					Shomaker 10/2014; OSE Well Record
C 03600 POD5	BH-21	Geotech	1/9/2013	X	Intercontinental Potash Corp	Shallow	24.33.26.423	637857	3562020	3548	75	dry						17	3531					Shomaker 10/2014; OSE Well Record
C 03600 POD2	BH-17	Geotech	1/8/2013	X	Intercontinental Potash Corp	Shallow	24.33.25.144	638824	3562329	3555	75	dry						24	3531					Shomaker 10/2014; OSE Well Record
C 03600 POD2	BH-18	Geotech	1/15/2013	X	Intercontinental Potash Corp	Shallow	24.33.25.144	638824	3562329	3555	75	dry						21	3534					Shomaker 10/2014; OSE Well Record
C 03600 POD7	BH-23	Geotech	1/9/2013	X	Intercontinental Potash Corp	Shallow	24.33.26.313	636726	356I968	3518	75	dry						66	3452					Shomaker 10/2014; OSE Well Record
C 03601 POD2	BH-9	Geotech	1/7/2013	X	Intercontinental Potash Corp	Shallow	24.33.23.423	637846	3563588	3575	75	dry						23	3552					Shomaker 10/2014; OSE Well Record
C 03601 POD6	BH-13	Geotech	1/5/2013	X	Intercontinental Potash Corp	Shallow	24.33.23.441	637833	3563338	3570	75	dry						24	3546					Shomaker 10/2014; OSE Well Record
C 03601 POD1	BH-8	Geotech	12/21/2012	X	Intercontinental Potash Corp	Shallow	24.33.24.113	638124	3563937	3582	100	dry						28	3554					Shomaker 10/2014; OSE Well Record
C 03601 POD5	BH-12	Geotech	1/6/2013	X	Intercontinental Potash Corp	Shallow	24.33.23.442	637988	3563334	3569	75	dry						31	3538					Shomaker 10/2014; OSE Well Record
C 03601 POD3	BH-10	Geotech	1/6/2013	X	Intercontinental Potash Corp	Shallow	24.33.24.331	638141	3563413	3571	75	dry						31	3540					Shomaker 10/2014; OSE Well Record
C 03601 POD7	BH-14	Geotech	1/5/2013	X	Intercontinental Potash Corp	Shallow	24.33.23.444	637946	3563170	3562	75	dry						27	3535					Shomaker 10/2014; OSE Well Record
C 03601 POD 4	BH-11	Geotech	1/4/2013	X	Intercontinental Potash Corp	Shallow	24.33.24.333	638136	3563222	3566	75	dry						35	3531					Shomaker 10/2014; OSE Well Record
C 03603	BH-24	Geotech	1/1/2013	X	Intercontinental Potash Corp	Shallow	24.33.35	637759	3561237	3521	75	dry						23	3498					OSE Well Record
C 03603	BH-25	Geotech	1/11/2013	X	Intercontinental Potash Corp	Shallow	24.33.35	637338	3561180	3514	75	dry						26	3488					OSE Well Record
C 03603	BH-26	Geotech	1/13/2013	X	Intercontinental Potash Corp	Shallow	24.33.35	636847	3561108	3507	75	dry						23	3484					OSE Well Record
C 03603	BH-27	Geotech	1/14/2013	X	Intercontinental Potash Corp	Shallow	24.33.35	637747	3560475	3511	75	dry						22	3489					OSE Well Record
C 03603	BH-28	Geotech	1/13/2013	X	Intercontinental Potash Corp	Shallow	24.33.35	636696	3560784	3501	75	dry						31	3470					OSE Well Record
C 03603	BH-29	Geotech	1/13/2013	X	Intercontinental Potash Corp	Shallow	24.33.35	636705	3560641	3502	75	dry						24	3478					OSE Well Record
USGS Observation Well																								
USGS 321348103340401		USGS Piezometer						634948	3566829	3601	36	22	3579											Shomaker 10/2014
Oil and Gas Wells																								
Tomcat Federal 8	25-38367	Gas	1/1/2008	X	Roff Operating		23.32.8.441	623313	3576043	3626	8800											1047	2579	NMOCD Record
Caza Ridge State 1	25-26692	Oil	12/4/1980	X	BTA Oil Producers		23.34.14.412	646992	3575069	3375	12942											1395	1980	NMOCD Record
Antelope Ridge 24	25-26547	SWD	8/7/1980	X	Natomas N America		23.34.24.321	648224	3573478	3371	13900											905	2466	NMOCD Record
Bell Lake 2	25-08489	Oil	11/2/1954	X	Continental Oil Co		23.34.30.342	640209	3571352	3633	13866							125	3508	450	3183	1255	2378	NMOCD Record; NMBM GW Report 6
Apco Ehrman 1	25-08674	SWD	8/11/1955	X	Apco Oil Corp		23.35.1.222	658645	3579316	3508	3748							50	3458			1620	1888	NMOCD Record
Red Hills BS 1	25-29008	Oil	1/3/1996	X	EOG Resources		24.33.24.411	639125	3563698	3565	15600											1250	2315	NMOCD Record
Bradley State 1	25-08248	SWD	12/23/1953	X	Fullerton Oil Co		25.32.36.331	628813	3550299	3345	4953											672	2673	NMOCD Record
Bass Federal 1	25-08385	Oil	7/25/1962	X	Curtis Hankamer		25.33.20.212	632816	3554795	3424	5074											1010	2414	NMOCD Record
Pitchblende Fed 2	25-27753	Oil	10/6/1996	X	EOG Resources		25.34.35.412	647353	3550937	3306	14091									556		934	2372	NMOCD Record

Table II.9.2 **Soils Laboratory Analyses Summary**
OWL Landfill Services, LLC

Sample Number[1]	Sample Depth (ft bgs)	USCS Class[2]	Grain Size Distribution			Atterberg Limits[3]		Natural Moisture[4] (%)	Standard Proctor		Permeability (cm/sec)	Porosity (%)[5]
			Pass #4 (%)	Pass #40 (%)	Pass #200 (%)	LL-PL	PI		Max Dry Density (PCF)	Optimum Moisture (%)		
BH1 - 3	15	SP-SM	82.1	39.7	8.3			5.99				38.39
BH1 - 12	82-85	SP-SM	99.0	70.6	6.0			3.68				37.13
BH1 Bucket	100	CL	100.0	71.0	51.2	31-15	16	4.90	130.4	10.6	2.87×10^{-8}	44.39
BH2 - 6	29	SP	92.0	72.2	3.1			6.67				43.18
BH2 Bucket	50	SP	96.2	63.4	4.3				120.5	12.4	4.23×10^{-5}	42.18
BH2 - 16	70	SC	100.0	55.5	30.8	37-20	17	17.52				40.75
BH3 - 5	20	SP-SM	100.0	97.9	6.6			8.38				33.15
BH3 Bucket	45	SP-SM	84.8	44.6	9.9				115.5	12.6	4.91×10^{-7}	36.15
BH3 - 16	128	SP-SM	99.8	55.0	9.6			6.49				38.97
BH4 - 3	15	SP-SM	87.0	72.4	10.3			9.28				43.90
BH4 - Bucket	45	CL	100.0	94.0	72.6	39-24	15	13.50	104.3	19.1	4.56×10^{-7}	
BH5 - 9	35	SP	96.2	61.5	4.0			10.37				43.06

Notes:

Blank field indicates test not conducted.

[1]See **Figure II.9.3** for locations of borings and **Attachment II.9.B** for boring logs.

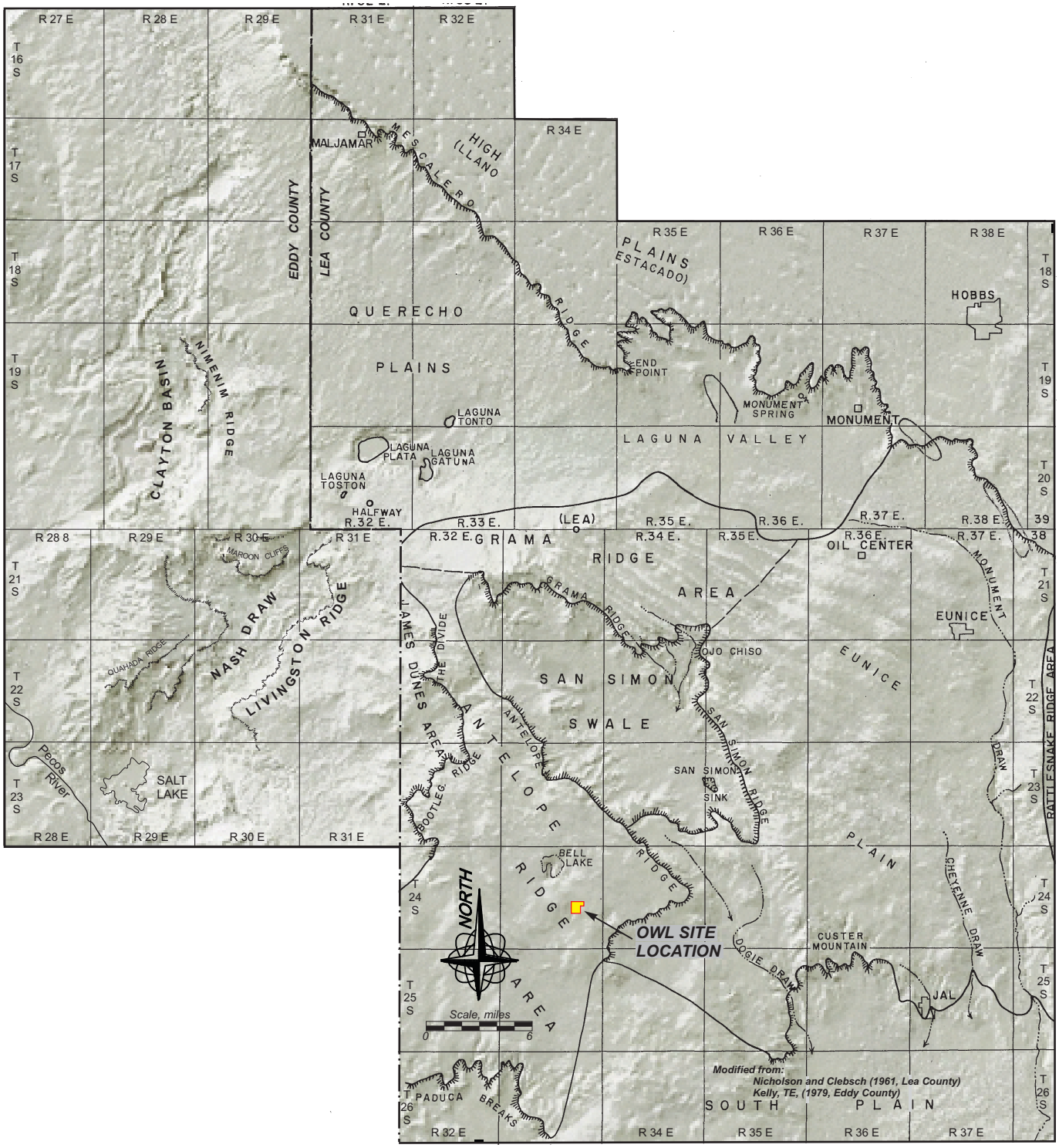
[2]Unified Soil Classification System: SM = silty sand; SP = poorly graded sand; SC = clayey sand; ML = low-plasticity silt; CL = low-plasticity clay; CH = high-plasticity clay

[3]LL = liquid limit; PL = plastic limit; PI = plasticity index

[4]Gravimetric basis

[5]Porosity = $(V_V/V)*100$

FIGURES



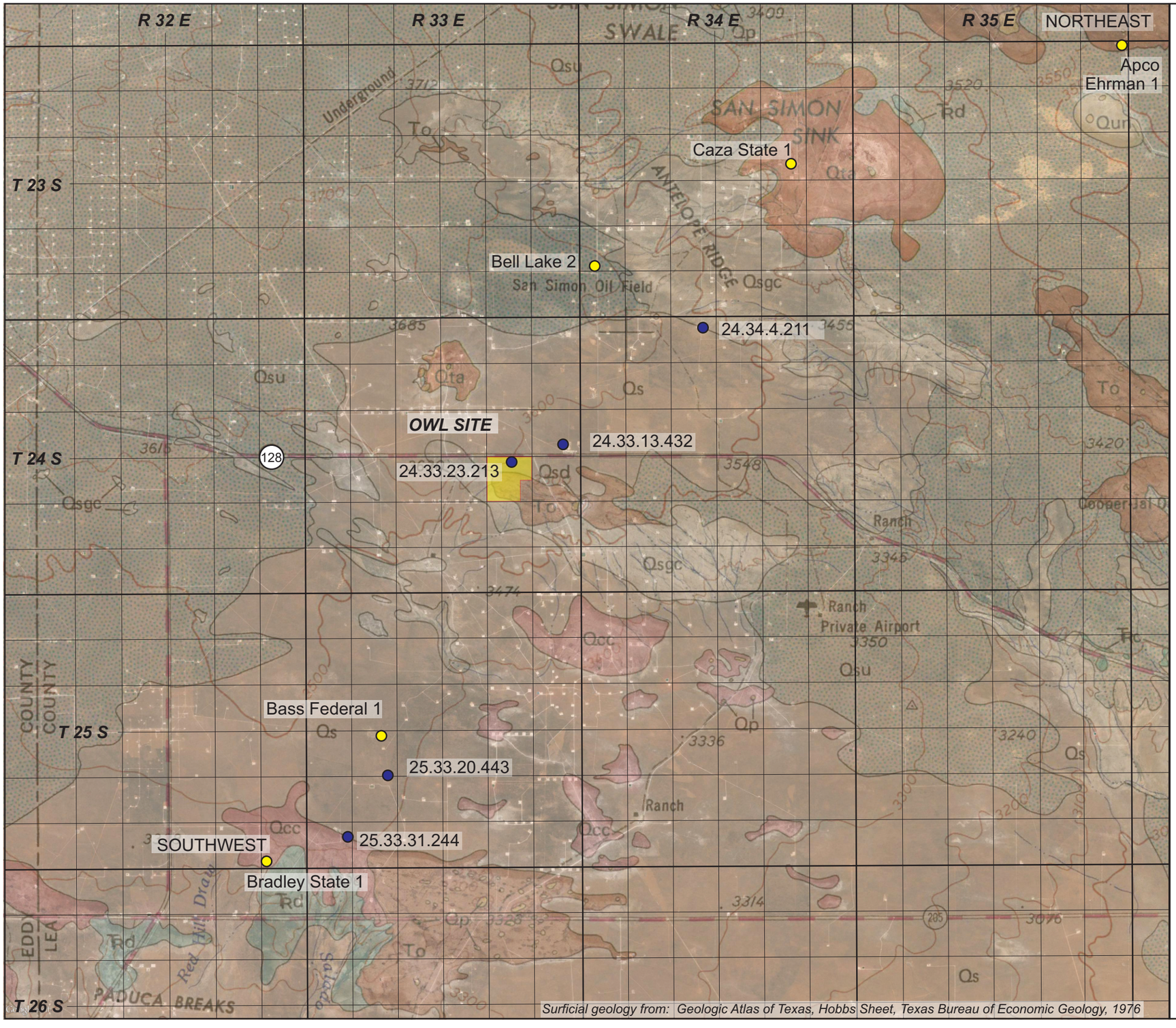
PROJECT

OWL Landfill Services, LLC
Lea County Site

TITLE

Figure II.9.1.--Physiography of southern Lea County and eastern Eddy County, New Mexico

Golder Associates
Albuquerque, New Mexico



Surficial geology from: Geologic Atlas of Texas, Hobbs Sheet, Texas Bureau of Economic Geology, 1976

EXPLANATION

Geologic Units

Qsu/Qs: Windblown sand
Sand and silt in sheets, light brown to reddish, overlies windblown cover sand; thickness 5-10 ft

Qp: Playa deposits
Playa deposits, clay and silt, sandy, light to dark gray, in shallow depressions

Qcc: Caliche
Caliche, stripped of covering materials mapped separately; thickness up to 10 ft

Qscg: Colluvial deposits
Sand, silt and gravel deposited by slopewash, and talus from Ogallala, red to gray; in part calcified, caliche 1-20 ft thick; may include weathered Gatuna Fm; rests mainly onTriassic and Permian rocks

Qta: Tahoka Formation
Lacustrine clay, silt, sand and gravel, locally calcareous, selenitic, indistinctly bedded to massive, weakly coherent, various shades of light gray, grades to gravel at margins. Contains molluscan and vertebrate fossils

To: Ogallala Formation
Fluvatile sand, silt, clay and gravel capped by caliche; various shades of gray and red; caliche, sandy, hard, ledge former; up to100 ft thickness

Trc/Td: Chinle Formation/Dockum Group
Claystone, micaceous, greenish red with reduction spots, interbedded with fine grained sandstone; Dockum group includes Santa Rosa Sandstone; cross-bedded, conglomeratic with mixed lithology, combined thickness 300 feet

24.34.4.211 — Water well showing PLS location

Apco Ehrman 1 — Oil/gas well showing well name

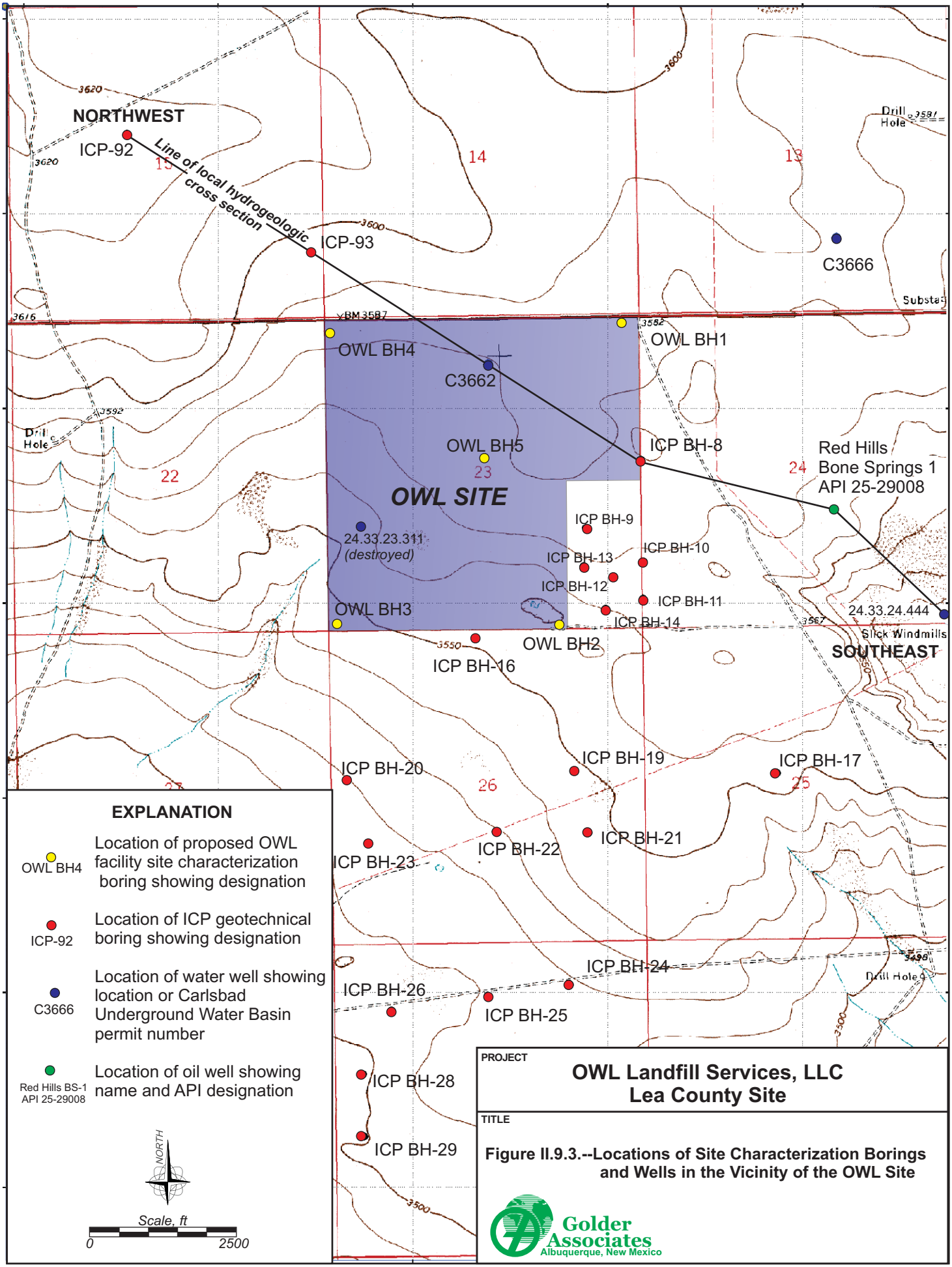
NORTH

Scale, miles
0 6

PROJECT
OWL Landfill Services, LLC
Lea County Site

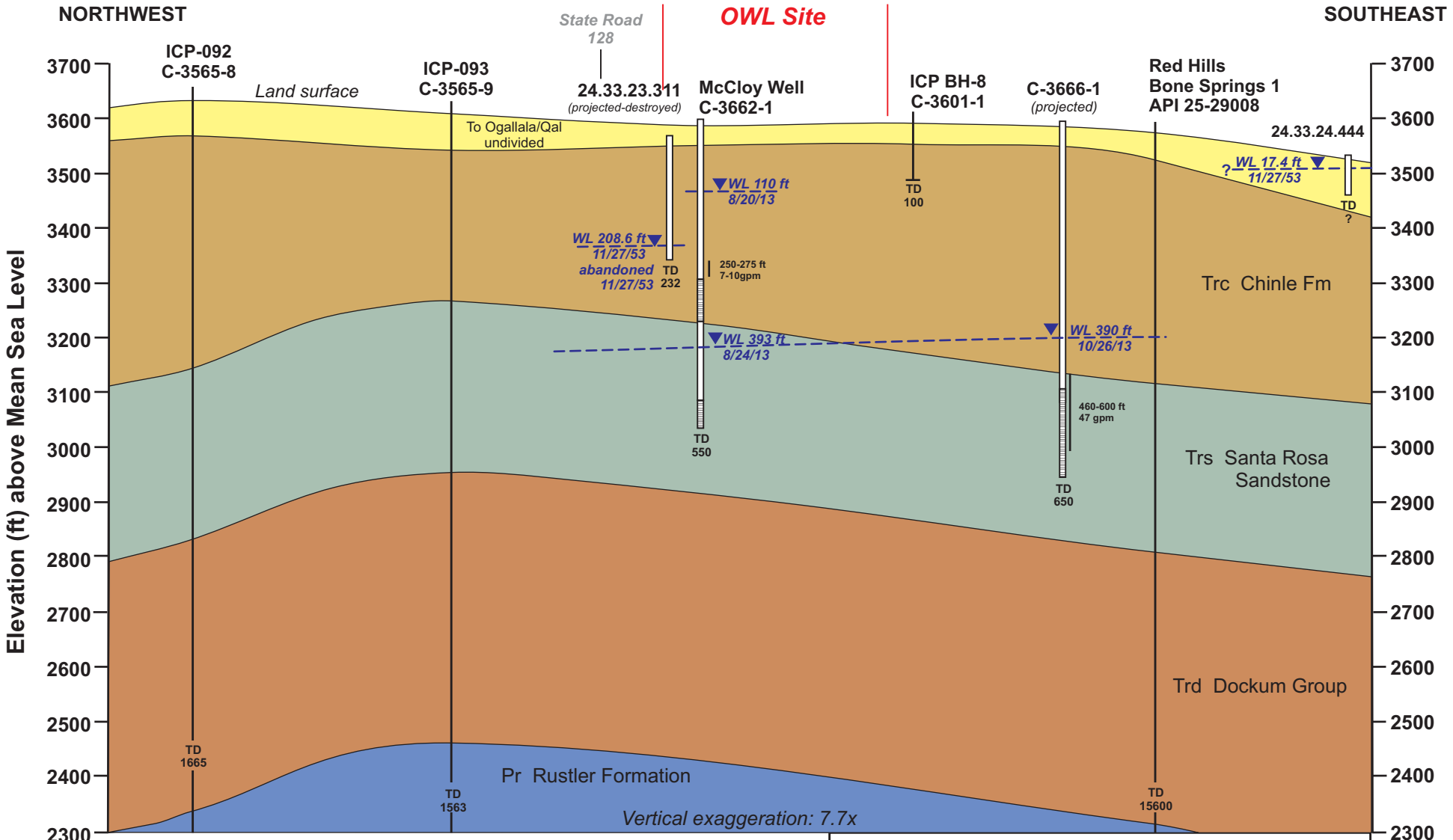
TITLE
Figure II.9.2.--Surficial Geology in the Vicinity of the OWL Site

Golder Associates
Albuquerque, New Mexico


NORTHWEST
ICP-92
Line of local hydrogeologic cross section
ICP-93
C3666
OWL BH4
C3662
OWL BH1
OWL BH5
ICP BH-8
OWL SITE
Red Hills Bone Springs 1
API 25-29008
24.33.23.311
(destroyed)
ICP BH-9
ICP BH-10
ICP BH-13
ICP BH-12
ICP BH-11
ICP BH-14
OWL BH3
OWL BH2
24.33.24.444
Slick Windmills
SOUTHEAST
ICP BH-16
ICP BH-20
ICP BH-19
ICP BH-17
ICP BH-22
ICP BH-21
ICP BH-23
ICP BH-24
ICP BH-26
ICP BH-25
ICP BH-28
ICP BH-29
EXPLANATION
OWL BH4
Location of proposed OWL facility site characterization boring showing designation
ICP-92
Location of ICP geotechnical boring showing designation
C3666
Location of water well showing location or Carlsbad Underground Water Basin permit number
Red Hills BS-1 API 25-29008
Location of oil well showing name and API designation
NORTH
Scale, ft
0
2500
PROJECT
OWL Landfill Services, LLC
Lea County Site
TITLE
Figure II.9.3.--Locations of Site Characterization Borings and Wells in the Vicinity of the OWL Site
Golder Associates
Albuquerque, New Mexico

Local Hydrogeologic Cross Section
OWL Site, Lea County, NM

Line of section shown in Figure II.9.3



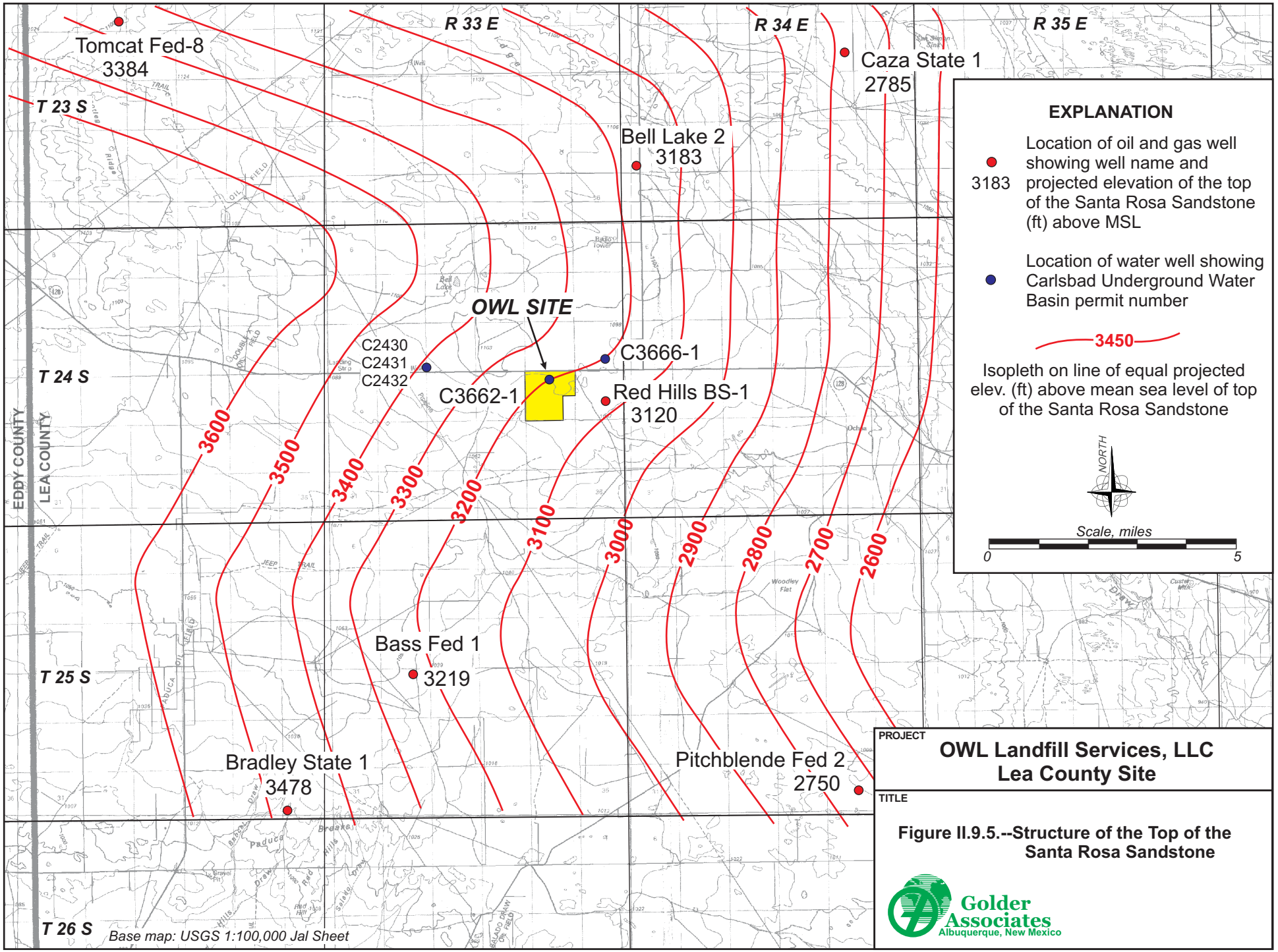
PROJECT

OWL Landfill Services, LLC
Lea County Site

TITLE

Figure II.9.4.--Local Hydrogeologic Cross Section
OWL Site, Lea County New Mexico

Golder Associates
Albuquerque, New Mexico



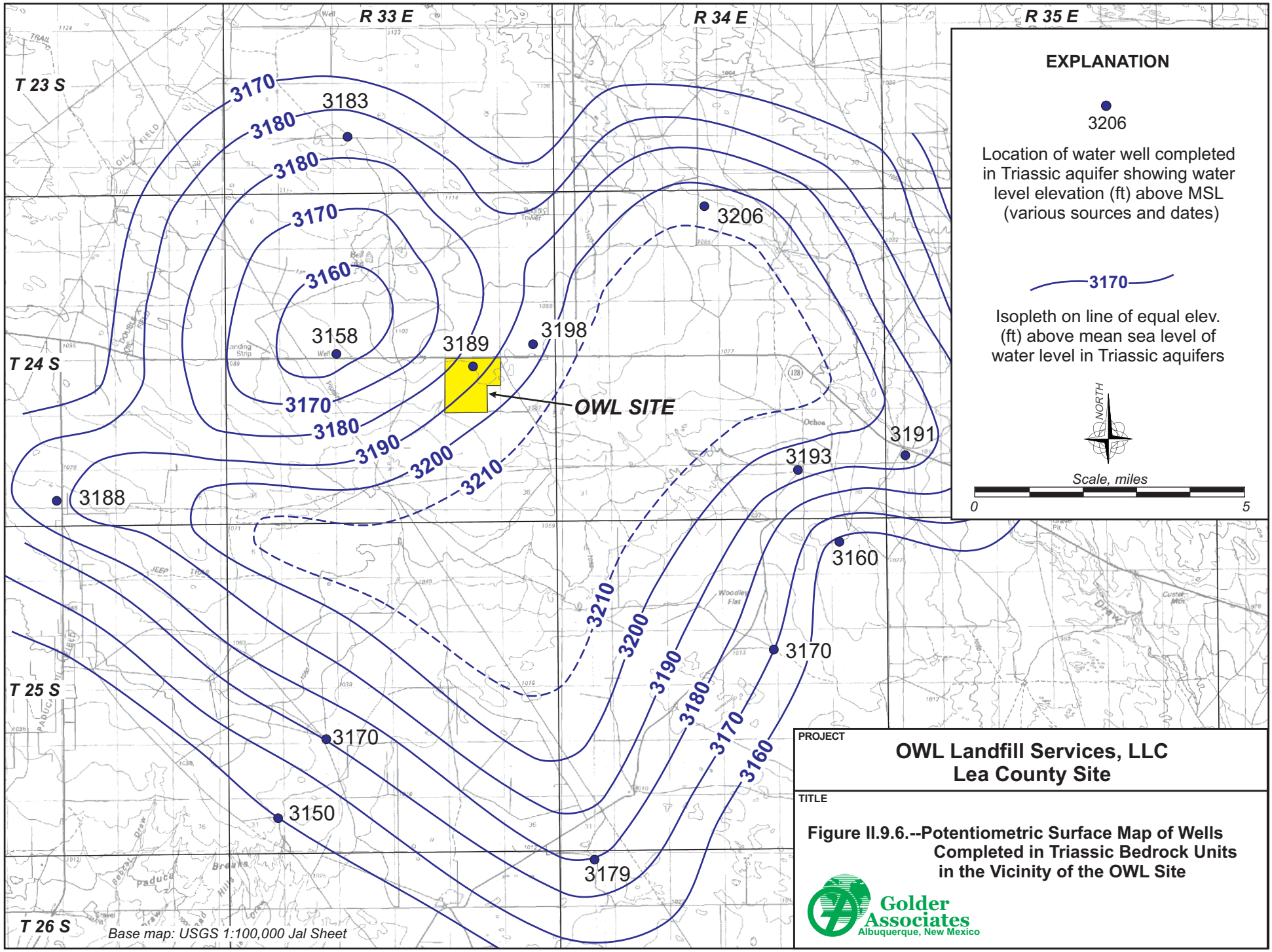
PROJECT

OWL Landfill Services, LLC
Lea County Site

TITLE

Figure II.9.5.--Structure of the Top of the Santa Rosa Sandstone

Golder Associates
Albuquerque, New Mexico



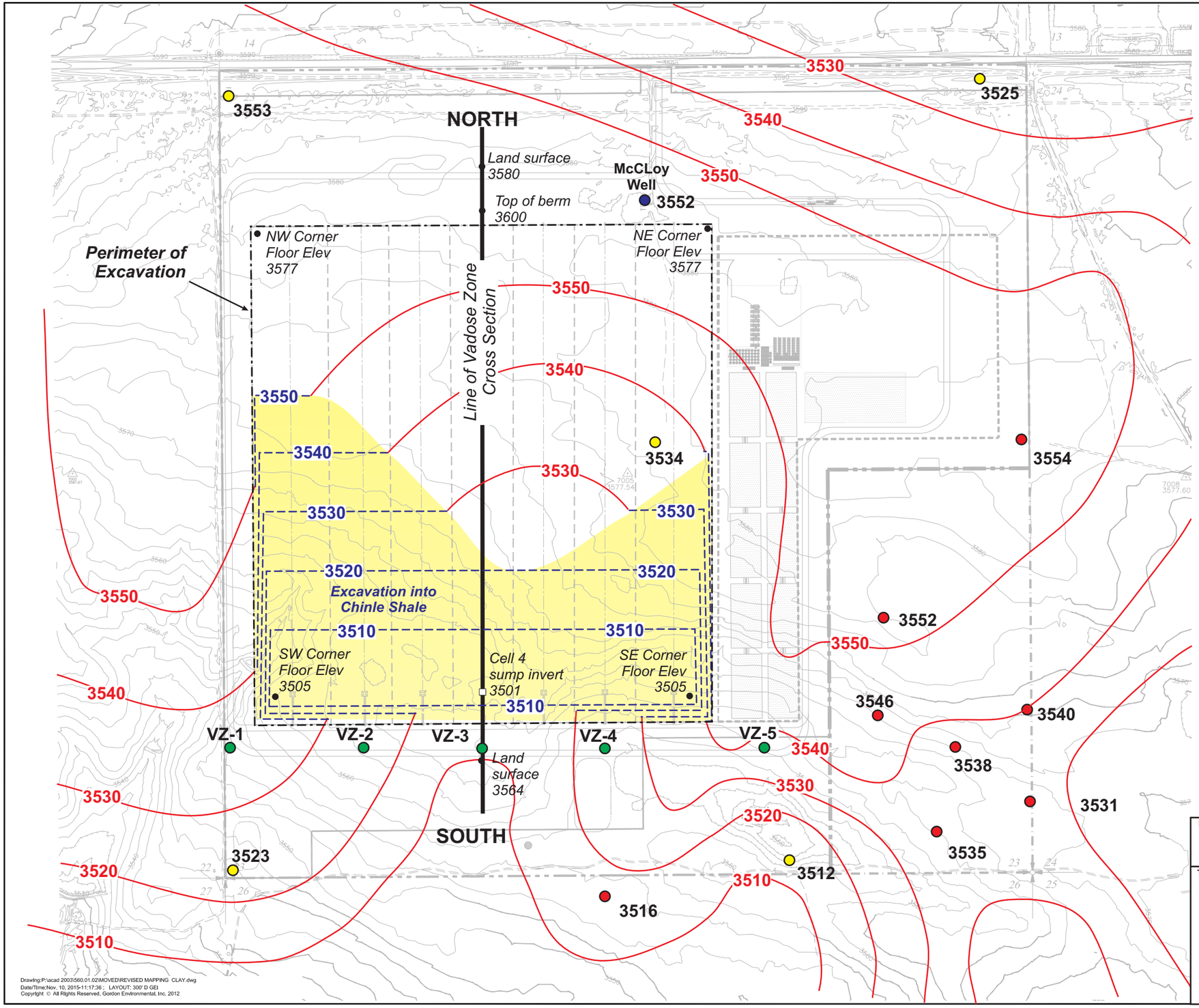
PROJECT

OWL Landfill Services, LLC
Lea County Site

TITLE

Figure II.9.6.--Potentiometric Surface Map of Wells Completed in Triassic Bedrock Units in the Vicinity of the OWL Site

Golder Associates
Albuquerque, New Mexico



LEGEND

3534 — OWL Site boring showing elevation of the top of the Chinle Shale, in feet above mean sea level

3552 — IC Potash site boring with elevation of the top of the Chinle Shale

VZ-1 — Location of proposed Owl Site vadose zone monitoring well

3550 — Isopleth on line of equal elevation on the top of the Chinle Shale

3550 — Isopleth on line of equal elevation on the top of the Chinle Shale penetrated by excavation

Area where basegrade of excavation penetrates into Chinle Shale

NORTH

0 300' 600'

PROJECT

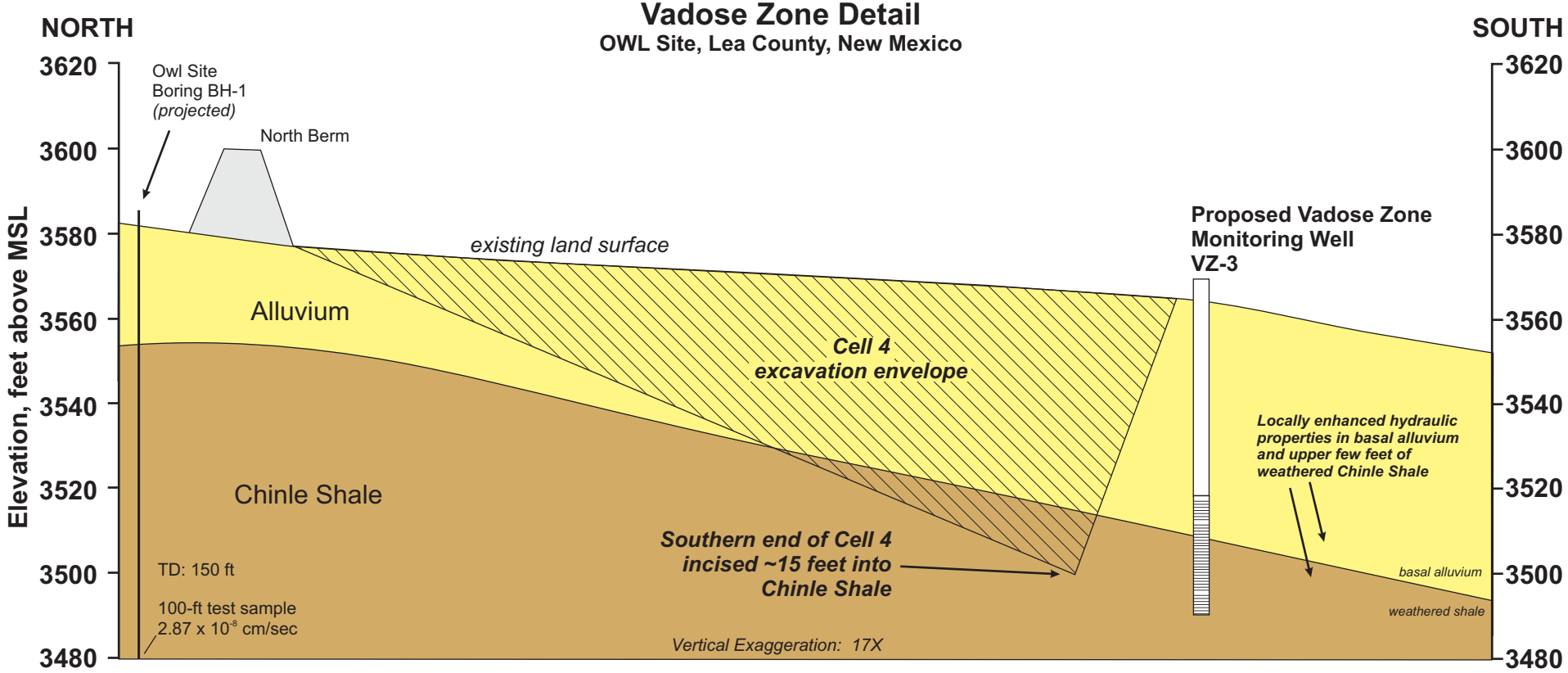
OWL Landfill Services, LLC
Lea County Site

TITLE

Figure II.9.7.--Structure of the Top of the Chinle Shale with Projected OWL Facillty Excavation

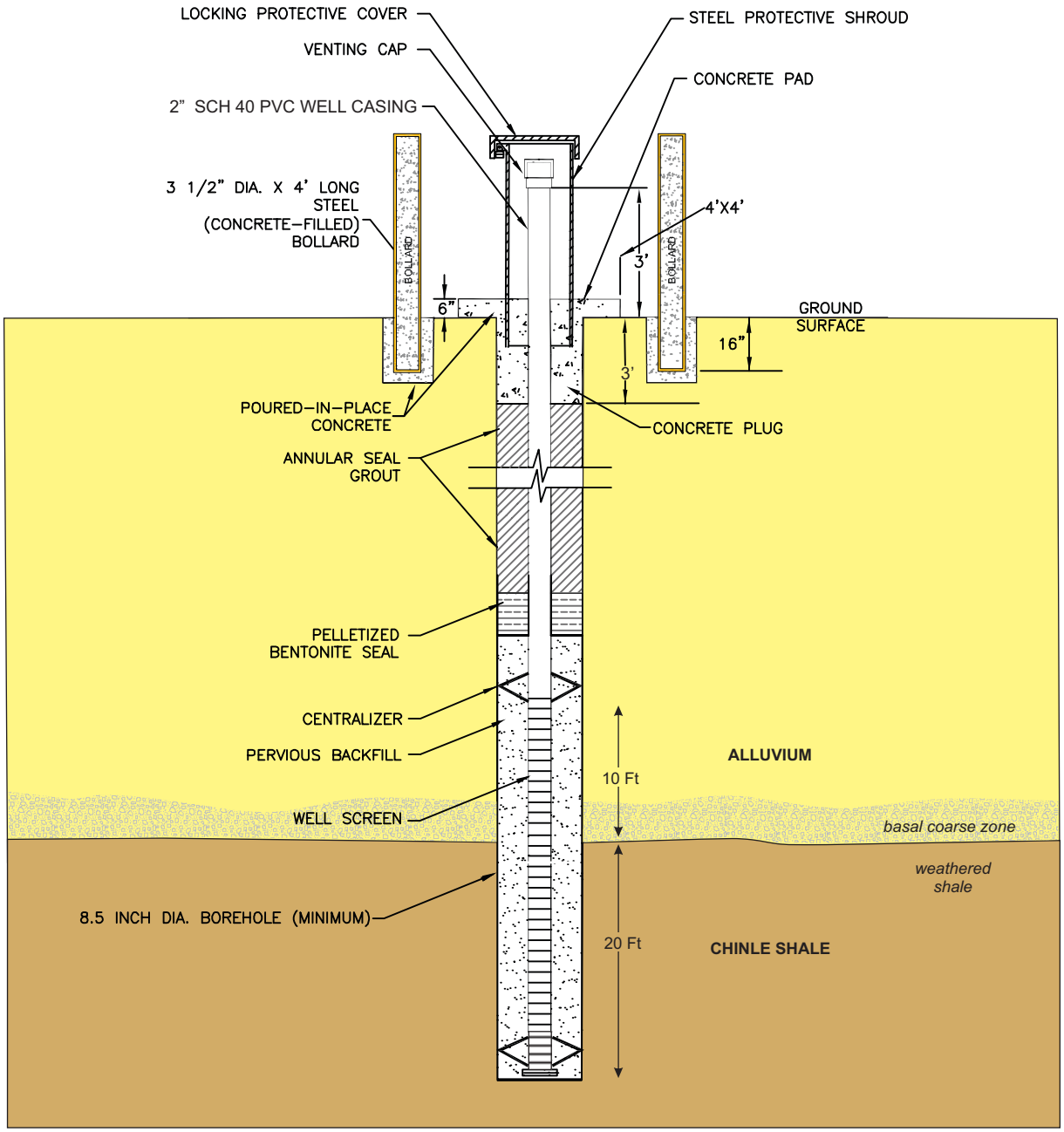
Golder Associates
Albuquerque, New Mexico

Geologic Cross Section
Vadose Zone Detail
OWL Site, Lea County, New Mexico



PROJECT	**OWL Landfill Services, LLC** **Lea County Site**
TITLE	**Figure II.9.8.--Vadose Zone Cross Section Detail** **OWL Site, Lea County New Mexico**

Golder Associates
Albuquerque, New Mexico



TYPICAL VADOSE ZONE MONITORING WELL

NOT TO SCALE

57

LEGEND

CASING: 2" DIA. SCH 40 PVC

SCREEN: 2" 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.

PROJECT

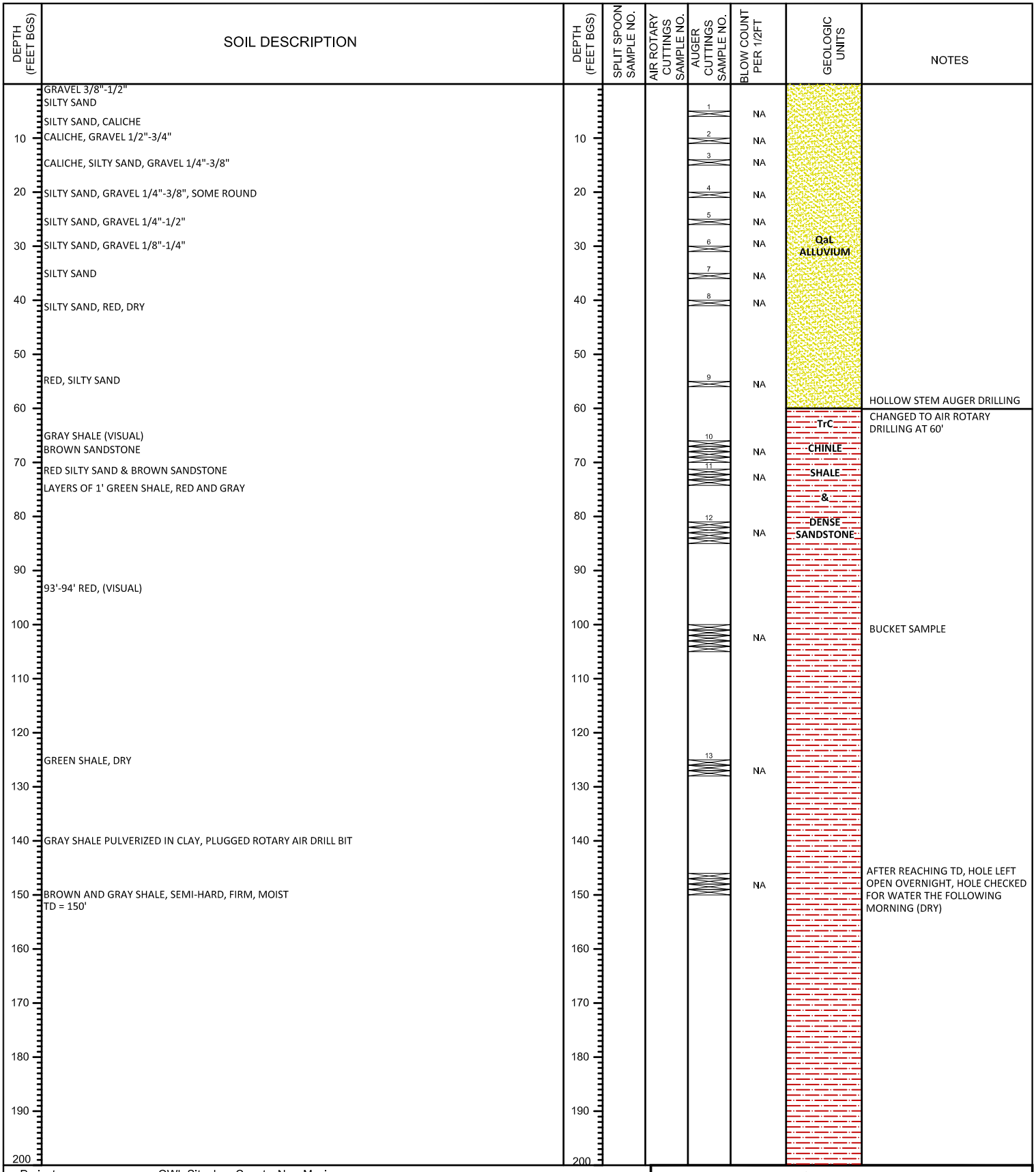
OWL Landfill Services, LLC
Lea County Site

TITLE

Figure II.9.9.--Proposed Vadose Zone Monitoring Well Completion

Golder Associates
Albuquerque, New Mexico

ATTACHMENT II.9.A
LOGS OF GEOTECHNICAL BORINGS AT THE OWL SITE



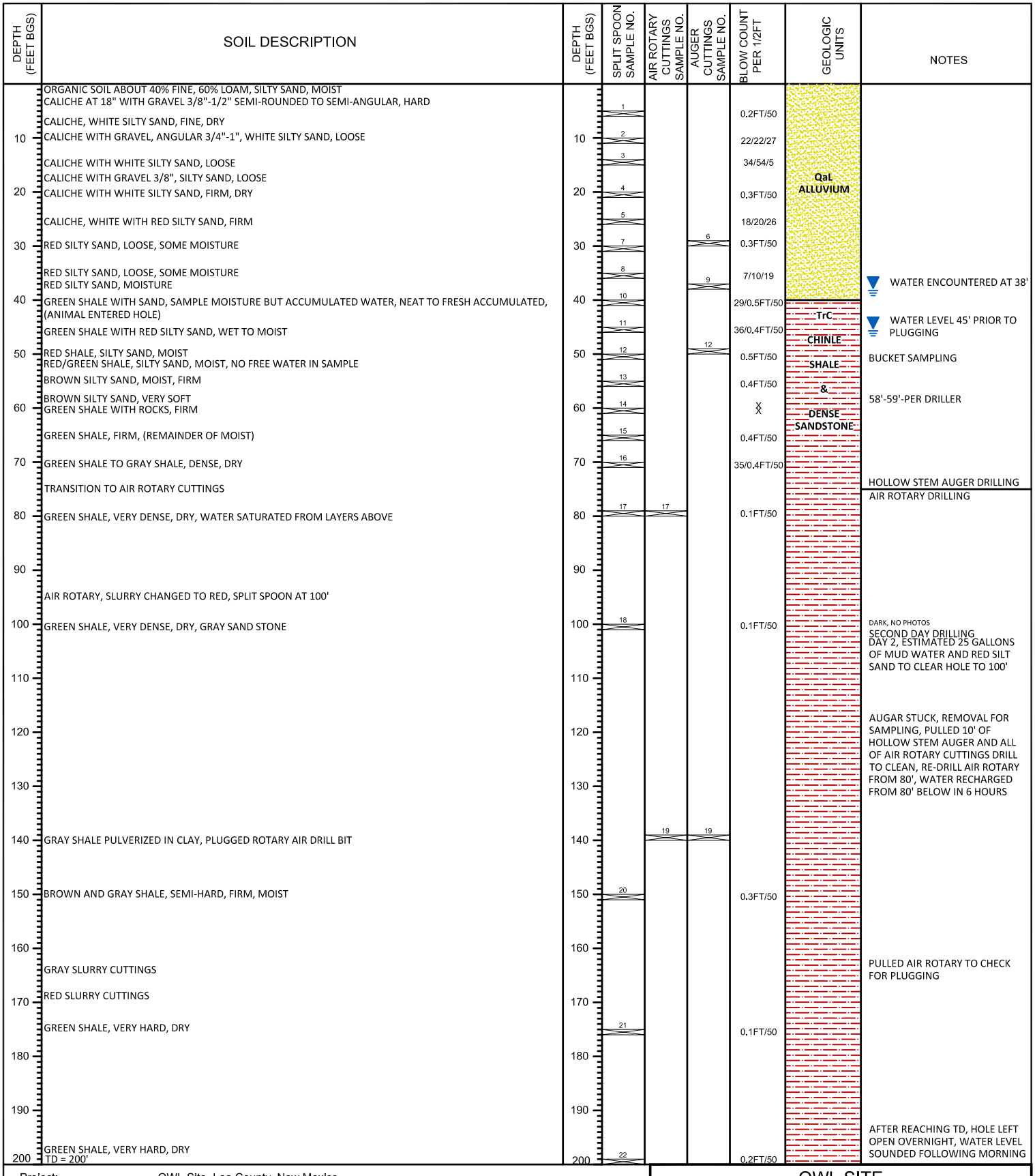
Project:	OWL Site, Lea County, New Mexico
Drilling Company:	Enviro Drill
Drilling Rig/Bit:	CME-75: Hollow Stem Auger/Air Rotary
Driller:	Ryan O'Malley
Sampling Method:	Split Spoon/Auger Cuttings
Location:	North East Corner of Section 23
Coordinate:	N 441088.401, E 788080.396
Elevation:	3584'
Start Date:	11/24/2015
Completion Date:	11/25/2015
Boring Depth:	150 feet below ground surface
Logged by:	Carl King

SOURCE: CARL KING, GORDON ENVIRONMENTAL

OWL SITE
LEA COUNTY, NEW MEXICO

SOIL BORING
BOREHOLE #1

Golder Associates



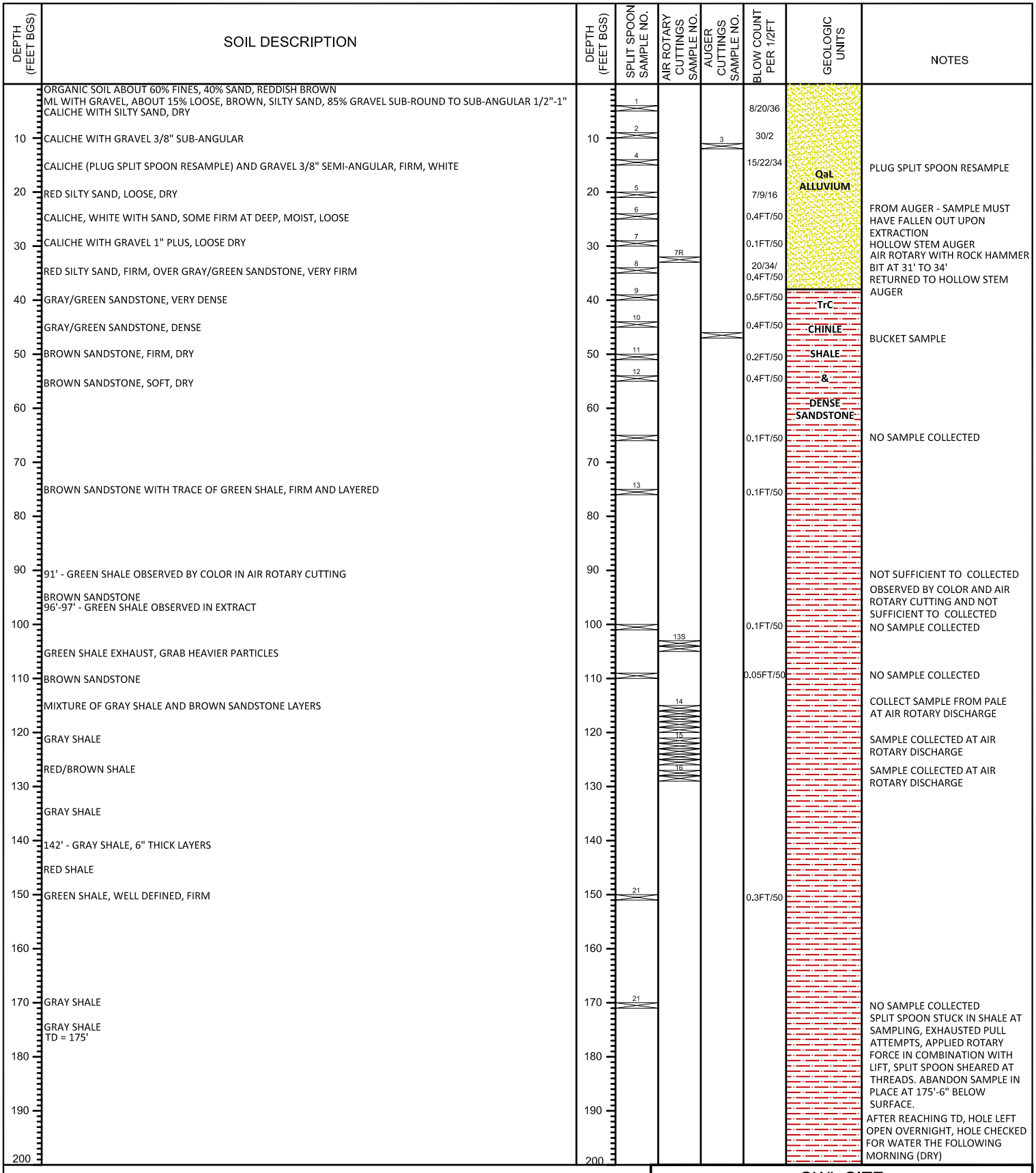
Project:	OWL Site, Lea County, New Mexico
Drilling Company:	Enviro Drill
Drilling Rig/Bit:	CME-75: Hollow Stem Auger/Air Rotary
Driller:	Ryan O'Malley
Sampling Method:	Split Spoon/Auger Cuttings
Location:	South East Corner of Section 23
Coordinate:	N 435985.091, E 786825.961
Elevation:	3553'
Start Date:	11/18/2015
Completion Date:	11/19/2015
Boring Depth:	200 feet below ground surface
Logged by:	Carl King

SOURCE: CARL KING, GORDON ENVIRONMENTAL

OWL SITE
LEA COUNTY, NEW MEXICO

SOIL BORING
BOREHOLE #2

Golder Associates



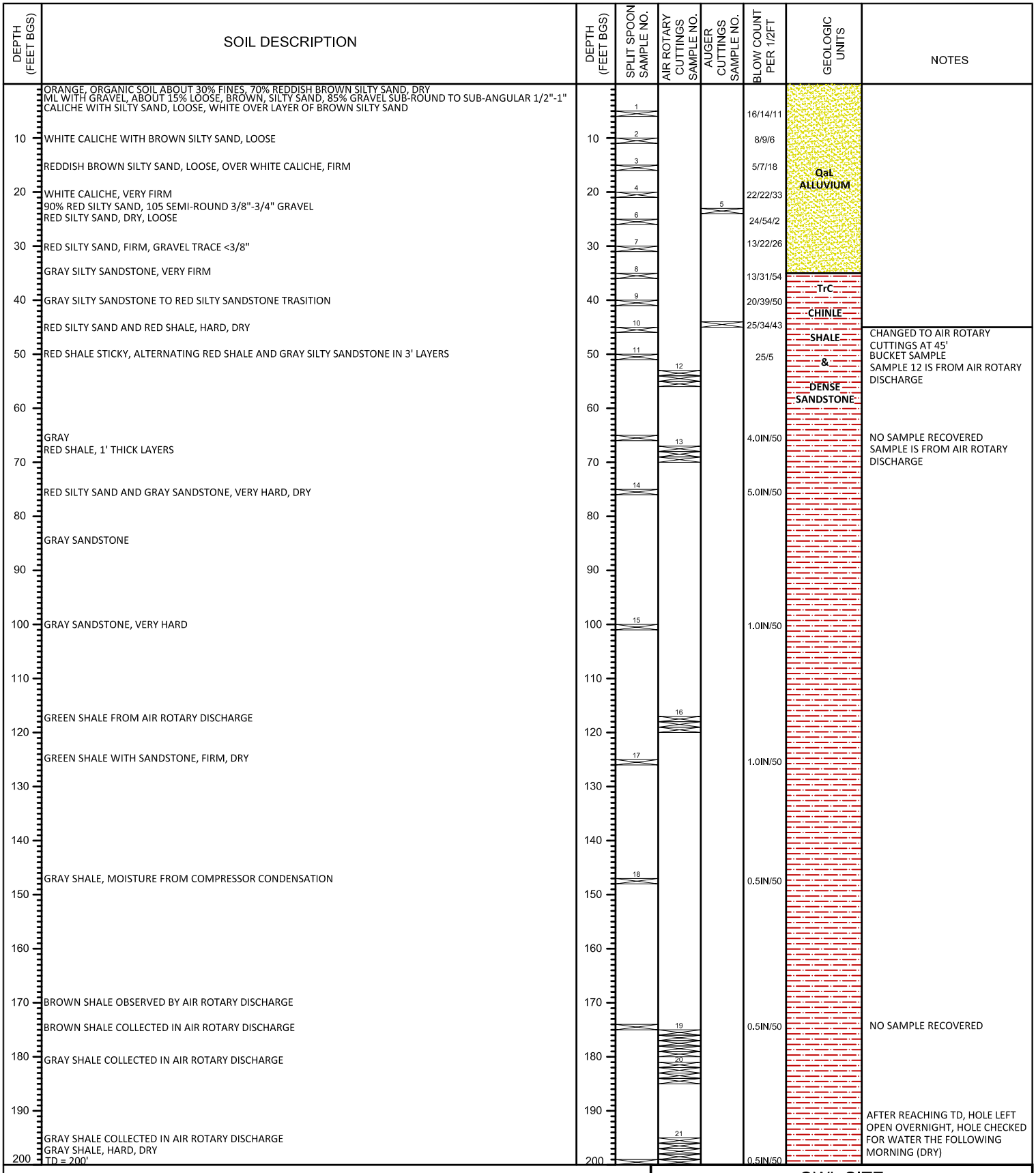
Project:	OWL Site, Lea County, New Mexico
Drilling Company:	Enviro Drill
Drilling Rig/Bit:	CME-75: Hollow Stem Auger/Air Rotary
Driller:	Ryan O'Malley
Sampling Method:	Split Spoon/Auger Cuttings
Location:	South West Corner of Section 23
Coordinate:	N 435917.137, E 783182.1299
Elevation:	3546'
Start Date:	11/20/2015
Completion Date:	11/25/2015
Boring Depth:	175 feet below ground surface
Logged by:	Carl King

SOURCE: CARL KING, GORDON ENVIRONMENTAL

OWL SITE
LEA COUNTY, NEW MEXICO

SOIL BORING
BOREHOLE #3

Golder Associates



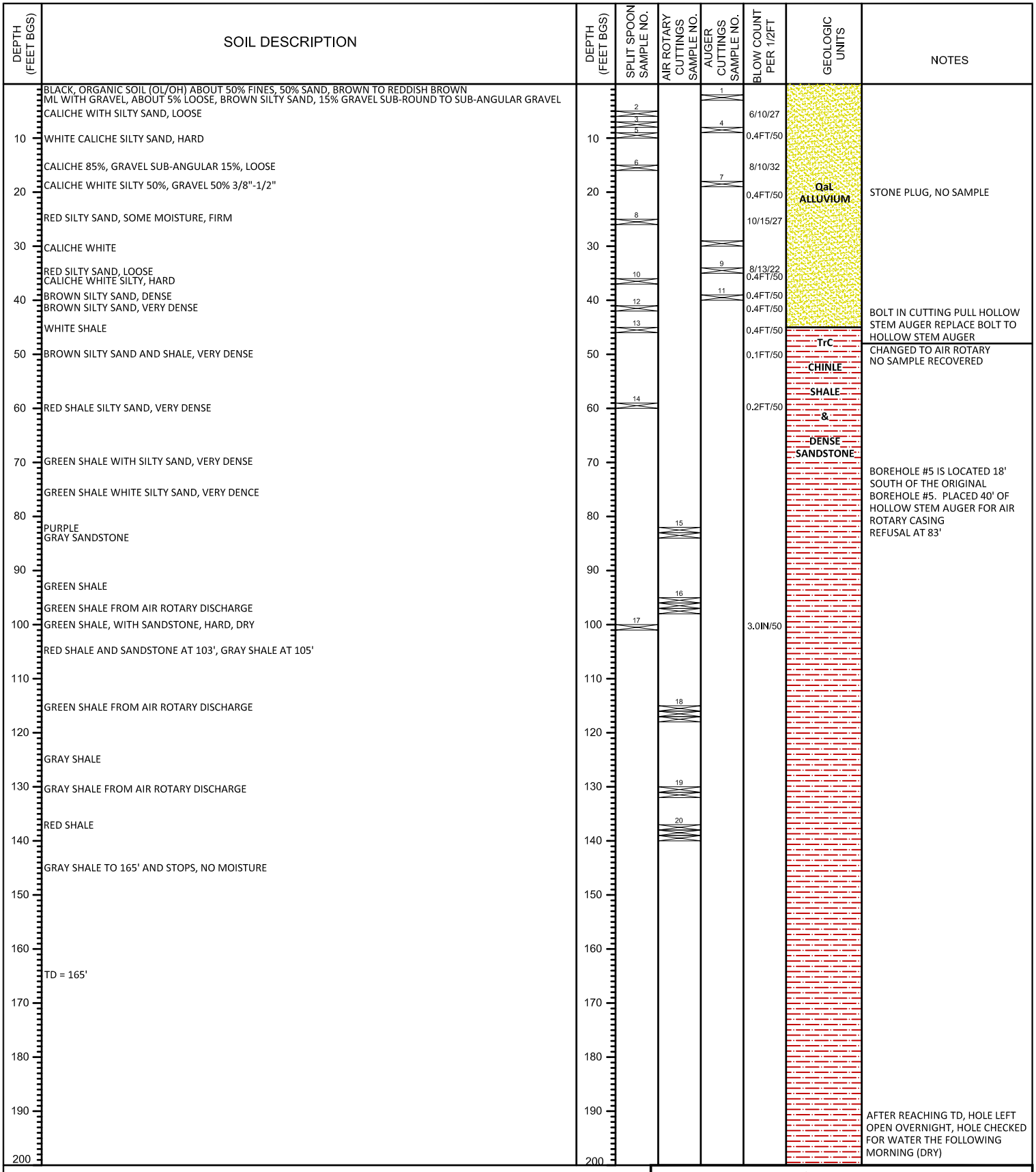
Project:	OWL Site, Lea County, New Mexico
Drilling Company:	Enviro Drill
Drilling Rig/Bit:	CME-75: Hollow Stem Auger/Air Rotary
Driller:	Ryan O'Malley
Sampling Method:	Split Spoon/Auger Cuttings
Location:	North West Corner of Section 23
Coordinate:	N 440977.229, E 783171.1478
Elevation:	3588'
Start Date:	11/22/2015
Completion Date:	11/25/2015
Boring Depth:	200 feet below ground surface
Logged by:	Carl King

SOURCE: CARL KING, GORDON ENVIRONMENTAL

OWL SITE
LEA COUNTY, NEW MEXICO

SOIL BORING
BOREHOLE #4

Golder Associates



Project:	OWL Site, Lea County, New Mexico
Drilling Company:	Enviro Drill
Drilling Rig/Bit:	CME-75: Hollow Stem Auger/Air Rotary
Driller:	Ryan O'Malley
Sampling Method:	Split Spoon/Auger Cuttings
Location:	Center of Section 23
Coordinate:	N 438707.209, E 785946.616
Elevation:	3579'
Start Date:	11/17/2015
Completion Date:	11/25/2015
Boring Depth:	165 feet below ground surface
Logged by:	Carl King

SOURCE: CARL KING, GORDON ENVIRONMENTAL

OWL SITE
LEA COUNTY, NEW MEXICO

SOIL BORING
BOREHOLE #5

Golder Associates

ATTACHMENT II.9.B
NMOSE WELL RECORDS FOR WELLS IN THE VICINITY OF THE OWL SITE

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

4-23-12

Corrected well log

1. GENERAL AND WELL LOCATION

POD NUMBER (WELL NUMBER)	OSE FILE NUMBER(S)
C-03528-POD1	C-03528-POD1
WELL OWNER NAME(S)	**PHONE (OPTIONAL)**
MARK & ANNETTE MCCLOY	432-940-4459
WELL OWNER MAILING ADDRESS	**CITY / STATE / ZIP**
PO BOX 1076	JAL / NM / 88252

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	13	29.00	N
LONGITUDE	103	39	44.60	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND

* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS

Coordinates Based on Map (Non-GPS)

2. OPTIONAL

(2.5 ACRE)	(10 ACRE)	(40 ACRE)	(160 ACRE)	SECTION	TOWNSHIP	RANGE
NW ¼	NW ¼	NW ¼	NE ¼	15	24 ☐ NORTH ☒ SOUTH	32 ☒ EAST ☐ WEST

SUBDIVISION NAME	LOT NUMBER	BLOCK NUMBER	UNIT/TRACT

HYDROGRAPHIC SURVEY	MAP NUMBER	TRACT NUMBER

3. DRILLING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD1682	JOHN NORRIS	HUNGRY HORSE,LLC

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
2-20-12	3-12-12	541	541	133

COMPLETED WELL IS: ☐ ARTESIAN ☐ DRY HOLE ☑ SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ☐ AIR ☑ MUD ☐ ADDITIVES – SPECIFY

DRILLING METHOD: ☑ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY

DEPTH (FT) FROM	DEPTH (FT) TO	BORE HOLE DIA. (IN)	CASING MATERIAL	CONNECTION TYPE (CASING)	INSIDE DIA. CASING (IN)	CASING WALL THICKNESS (IN)	SLOT SIZE (IN)
0	541	8 3/4	PVC	GLUED	6"	3/8	1/8

4. WATER BEARING STRATA

DEPTH (FT) FROM	DEPTH (FT) TO	THICKNESS (FT)	FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	YIELD (GPM)
133	152	19	SAND	UK

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: N/A

TOTAL ESTIMATED WELL YIELD (GPM):

2012 APR 30 A 11:11

STATE ENGINEER OFFICE

FOR OSE INTERNAL USE — WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER C-3528 | POD NUMBER C-03528-POD1 | TRN NUMBER 491386

LOCATION 24.32.15.211

5. SEAL AND PUMP

TYPE OF PUMP: ☐ SUBMERSIBLE ☐ JET ☐ NO PUMP – WELL NOT EQUIPPED
☐ TURBINE ☐ CYLINDER ☐ OTHER – SPECIFY: UNKNOWN

ANNULAR SEAL AND GRAVEL PACK	DEPTH (FT) FROM	DEPTH (FT) TO	BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	AMOUNT (CUBIC FT)	METHOD OF PLACEMENT
	0	20	8 3/4	GROUT & CEMENT	8	TOP

6. GEOLOGIC LOG OF WELL

DEPTH (FT) FROM	DEPTH (FT) TO	THICKNESS (FT)	COLOR AND TYPE OF MATERIAL ENCOUNTERED (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	WATER BEARING?
0	3	3	TOPSOIL	☐ YES ☑ NO
3	18	15	CALICHE	☐ YES ☑ NO
18	26	8	SAND	☑ YES ☐ NO
26	133	107	RED CLAY	☐ YES ☑ NO
133	152	19	SAND	☑ YES ☐ NO
152	318	166	RED CLAY	☐ YES ☑ NO
318	345	27	SAND	☑ YES ☐ NO
345	384	39	RED CLAY AND ROCK	☐ YES ☑ NO
384	418	34	SAND	☑ YES ☐ NO
418	444	26	RED CLAY AND ROCK	☐ YES ☑ NO
444	468	24	SAND	☑ YES ☐ NO
468	500	32	RED CLAY	☐ YES ☑ NO
500	508	8	SAND	☑ YES ☐ NO
508	541	33	RED CLAY AND ROCK	☐ YES ☑ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO

ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL

7. TEST & ADDITIONAL INFO

WELL TEST — METHOD: ☐ BAILER ☐ PUMP ☐ AIR LIFT ☐ OTHER – SPECIFY N/A

TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD

ADDITIONAL STATEMENTS OR EXPLANATIONS

8. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING

John Nor — SIGNATURE OF DRILLER

4-23-12 — DATE

FOR OSE INTERNAL USE

WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER C-3528	POD NUMBER C-03528-POD1	TRN NUMBER 491386
LOCATION 24.32.15.2111		PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 29 P 2:20

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER)	OSE FILE NUMBER(S)
BH 16	C3600; 518382
WELL OWNER NAME(S)	PHONE (OPTIONAL)
INTERCONTINENTAL POTASH CORP	
WELL OWNER MAILING ADDRESS	CITY / STATE / ZIP
600 W. BENDER BLVD.	HOBBS / NM / 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	11	43.4	N
LONGITUDE	103	32	37.1	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

T24S; R 33E; SECTION 26

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-07-13	01-07-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD — ADDITIVES - SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER - SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3600	POD NUMBER	BH 16	TRN NUMBER	518382
LOCATION	24S.33E.26				PAGE 1 OF 2

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO
2013 JAN 28 P 2:

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	3	3	BROWN SILTY SAND, LOOSE	○ Y ◉ N	N/A
3	18	15	CALICHE WHITE SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
18	37	19	RED SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
37	75	38	SHALE GREEN SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

5. TEST; RIG SUPERVISION

WELL TEST: TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rodney Hammer — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

1-23-13 — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	POD NUMBER	TRN NUMBER
C-3600	BH-16	518382

LOCATION

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2 P 1:25

1. GENERAL AND WELL LOCATION

POD NUMBER (WELL NUMBER)	OSE FILE NUMBER(S)
ICP-093	C-3565-POD 9

WELL OWNER NAME(S)	PHONE (OPTIONAL)
Intercontinental Potash (USA)	575-942-2799

WELL OWNER MAILING ADDRESS	CITY	STATE	ZIP
600 West Bender Boulevard	Hobbs	NM	88240

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32	12	48.09	N
	LONGITUDE	103	33	8.31	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS

2. OPTIONAL

(2.5 ACRE)	(10 ACRE)	(40 ACRE)	(160 ACRE)	SECTION	TOWNSHIP		RANGE	
¼	¼	¼	¼	15	24	☐ NORTH ☑ SOUTH	33	☑ EAST ☐ WEST

SUBDIVISION NAME	LOT NUMBER	BLOCK NUMBER	UNIT/TRACT

HYDROGRAPHIC SURVEY	MAP NUMBER	TRACT NUMBER

3. DRILLING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD #331	Phillip Stewart	Stewart Brothers Drilling Co.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01/11/2013	02/19/2013	NA	1562.80 FT	NA

COMPLETED WELL IS: ☐ ARTESIAN ☑ DRY HOLE ☐ SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ☐ AIR ☑ MUD ☐ ADDITIVES – SPECIFY: ETH GEL, PLATINUM PAC, BI-CARB, SODA ASH,

DRILLING METHOD: ☑ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY: TACKLE, MYLOGEL, NaCl

DEPTH (FT) FROM	DEPTH (FT) TO	BORE HOLE DIA. (IN)	CASING MATERIAL	CONNECTION TYPE (CASING)	INSIDE DIA. CASING (IN)	CASING WALL THICKNESS (IN)	SLOT SIZE (IN)
0	1245	12.25	J-55 #20 steel	theaded	6.456	0.272	
1245	1562.80		NA				

4. WATER BEARING STRATA

DEPTH (FT) FROM	DEPTH (FT) TO	THICKNESS (FT)	FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	YIELD (GPM)
NA		NA	NA	NA

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA	TOTAL ESTIMATED WELL YIELD (GPM)
Bypass flow	na

FOR OSE INTERNAL USE — WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER C-3565	POD NUMBER 9	TRN NUMBER 509298
LOCATION T24S R33E Sec 15		PAGE 1 OF 2

5. SEAL AND PUMP

TYPE OF PUMP: ☐ SUBMERSIBLE ☐ JET ☑ NO PUMP – WELL NOT EQUIPPED
☐ TURBINE ☐ CYLINDER ☐ OTHER – SPECIFY: STATE ENGINEER OFFICE

2013 APR -2 (illegible) 25

ANNULAR SEAL AND GRAVEL PACK	DEPTH (FT) FROM	TO	BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	AMOUNT (CUBIC FT)	METHOD OF PLACEMENT
	NA		NA	NA	NA	NA

6. GEOLOGIC LOG OF WELL

DEPTH (FT) FROM	TO	THICKNESS (FT)	COLOR AND TYPE OF MATERIAL ENCOUNTERED (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	WATER BEARING?
0	20	20	Caliche	☐ YES ☑ NO
20	55	35	Gutuna Fm. - red siltstones and sandstones	☐ YES ☑ NO
55	1238	1183	Dewey Lake Fm.Red siltstones and mudstones, gray/green mottling	☐ YES ☑ NO
1138	1275	137	Rustler Fm./A-5, white anhydrite	☐ YES ☑ NO
1275	1306	31	H-4 sub-mbr. - milky white halite	☐ YES ☑ NO
1306	1320	14	A-4 sub-mbr. - white anhydrite	☐ YES ☑ NO
1320	1338	18	Magenta Dolomite	☐ YES ☑ NO
1338	1386	48	A-3 sub-mbr. white anhydrite	☐ YES ☑ NO
1386	1491	110	H-3 sub-mbr. - milky halite	☐ YES ☑ NO
1491	1501	10	Ore zone, anhydrite and white polyhalite	☐ YES ☑ NO
1501	1562	61	Halite and red mudstones	☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO

ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL

7. TEST & ADDITIONAL INFO

WELL TEST — METHOD: ☐ BAILER ☐ PUMP ☐ AIR LIFT ☐ OTHER – SPECIFY: NA

TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

ADDITIONAL STATEMENTS OR EXPLANATIONS:

8. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

SIGNATURE OF DRILLER — DATE: 3-27-13

FOR OSE INTERNAL USE — WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER	C-3565	POD NUMBER	9	TRN NUMBER	
LOCATION	T24S R33E Sec 15				PAGE 2 OF 2

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
ROSWELL

Scott A. Verhines, P.E.
State Engineer

DISTRICT II
1900 West Second St.
Roswell, New Mexico 88201
Phone: (575) 622-6521
Fax: (575) 623-8559

April 18, 2013

Intercontinental Potash
Attn: Allen Hall
600 West Bender Boulevard
Hobbs, NM 88240

RE: *Well Logs* for C-3565 POD 8 and C-3565 POD 9

Greetings:

We have received and filed your Well Logs for the above referenced wells.

Sincerely,

Catherine Goetz
Water Resource Specialist
District II Office of the State Engineer

Enclosures
cc: Office of State Engineer, Santa Fe

Goetz, Catherine, OSE

From: Allen Hall [ahall@icpotash.com]
Sent: Monday, April 15, 2013 11:27 AM
To: Goetz, Catherine, OSE
Subject: RE: ICP-092 and ICP-093

Hi Catherine,

The borehole diameters for ICP092 and ICP093 were 12.25", from surface to casing depth, below casing 6.25". DST's were conducted on the Magenta mbr., and the Culebra mbr. In borehole ICP092, but not in ICP093. ICP had INTERA run the tests on the hydrology of these two mbrs., our concern was water from these units impacting the mine shaft in the furture. I need to contact Tim Dale at INTERA for the results of the Drill Stem Tests.

Thanks,

Allen

From: Goetz, Catherine, OSE [mailto:Catherine.Goetz@state.nm.us]
Sent: Monday, April 15, 2013 9:01 AM
To: Allen Hall
Subject: ICP-092 and ICP-093

Hi Mr. Hall,

Trying to get some items off the desk.
I received the Well Record and Log from the Stewart brothers for C-3565 POD 8 (ICP-092) and C-3565 POD9 (ICP-093).

Do you have the borehole diameters and if water bearing or not for the lower intervals for both wells?
ICP-092: 1245 to 1665 ft
ICP-093: 1245 to 1562.8 ft

Want to attach to well record so I can file these documents.
If you prefer, I'll contact Stewart Bros. for the info.

Thanks,
Cath Goetz

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2012 DEC 11 P 4: 02

1. GENERAL AND WELL LOCATION

POD NUMBER (WELL NUMBER)	OSE FILE NUMBER(S)
ICP-085	C-3565 POD 3
WELL OWNER NAME(S)	PHONE (OPTIONAL)
Intercontinental Potash (USA)	575-942-2799
WELL OWNER MAILING ADDRESS	CITY / STATE / ZIP
600 West Bender Boulevard	Hobbs / NM / 88240

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32	13	39.75	N
	LONGITUDE	103	35	27.62	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS

2. OPTIONAL

(2.5 ACRE)	(10 ACRE)	(40 ACRE)	(160 ACRE)	SECTION	TOWNSHIP	RANGE
¼	¼	¼	¼	8	24 ☐ NORTH ☑ SOUTH	33 ☑ EAST ☐ WEST

SUBDIVISION NAME	LOT NUMBER	BLOCK NUMBER	UNIT/TRACT

HYDROGRAPHIC SURVEY	MAP NUMBER	TRACT NUMBER

3. DRILLING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD #331	Phillip Stewart	Stewart Brothers Drilling Co.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
9/27/2012	10/21/2012	NA	1533 FT	NA

COMPLETED WELL IS: ☐ ARTESIAN ☑ DRY HOLE ☐ SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT): NA

DRILLING FLUID: ☐ AIR ☑ MUD ☐ ADDITIVES – SPECIFY: ETH GEL, PLATINUM PAC, BI-CARB, SODA ASH,

DRILLING METHOD: ☑ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY: TACKLE, MYLOGEL, NaCl

DEPTH (FT) FROM	DEPTH (FT) TO	BORE HOLE DIA. (IN)	CASING MATERIAL	CONNECTION TYPE (CASING)	INSIDE DIA. CASING (IN)	CASING WALL THICKNESS (IN)	SLOT SIZE (IN)
0	1250	12.625	J-55 #36 steel	theaded	8.921	0.302	
1250	1533	8.75	NA				

4. WATER BEARING STRATA

DEPTH (FT) FROM	DEPTH (FT) TO	THICKNESS (FT)	FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	YIELD (GPM)
NA		NA	NA	NA

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA	TOTAL ESTIMATED WELL YIELD (GPM)
Bypass flow	na

FOR OSE INTERNAL USE — WELL RECORD & LOG (Version 09/08)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		PAGE 1 OF 2

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO
2012 DEC 11 P 1:02

5. SEAL AND PUMP

TYPE OF PUMP: ☐ SUBMERSIBLE ☐ JET ☑ NO PUMP – WELL NOT EQUIPPED
☐ TURBINE ☐ CYLINDER ☐ OTHER – SPECIFY:

ANNULAR SEAL AND GRAVEL PACK	DEPTH (FT) FROM	DEPTH (FT) TO	BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	AMOUNT (CUBIC FT)	METHOD OF PLACEMENT
	NA		NA	NA	NA	NA

6. GEOLOGIC LOG OF WELL

DEPTH (FT) FROM	DEPTH (FT) TO	THICKNESS (FT)	COLOR AND TYPE OF MATERIAL ENCOUNTERED (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	WATER BEARING?
0	20	20	Caliche	☐ YES ☑ NO
20	55	35	Gutuna Fm. - red siltstones and sandstones	☐ YES ☑ NO
55	1227	1181	Dewey Lake Fm.Red siltstones and mudstones, gray/green mottling	☐ YES ☑ NO
1227	1262	35	Rustler Fm./A-5, white anhydrite	☐ YES ☑ NO
1262	1295	33	H-4 sub-mbr. - milky white halite	☐ YES ☑ NO
1295	1310	15	A-4 sub-mbr. - white anhydrite	☐ YES ☑ NO
1310	1330	20	Magenta Dolomite	☐ YES ☑ NO
1330	1375	45	A-3 sub-mbr. white anhydrite	☐ YES ☑ NO
1375	1479	112	H-3 sub-mbr. - milky halite	☐ YES ☑ NO
1479	1489	10	Ore zone, anhydrite and white polyhalite	☐ YES ☑ NO
1489	1533	44	Halite, with some anhydrite	☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO

ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL

7. TEST & ADDITIONAL INFO

WELL TEST: METHOD: ☐ BAILER ☐ PUMP ☐ AIR LIFT ☐ OTHER – SPECIFY: NA

TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

ADDITIONAL STATEMENTS OR EXPLANATIONS:

8. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rodney D. Stout — SIGNATURE OF DRILLER

12-10-12 — DATE

FOR OSE INTERNAL USE — WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2012 DEC 11 P 4: 02

1. GENERAL AND WELL LOCATION

POD NUMBER (WELL NUMBER)	OSE FILE NUMBER(S)
ICP-085	C-3565 POD 3
WELL OWNER NAME(S)	**PHONE (OPTIONAL)**
Intercontinental Potash (USA)	575-942-2799
WELL OWNER MAILING ADDRESS	**CITY / STATE / ZIP**
600 West Bender Boulevard	Hobbs / NM / 88240

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32	13	39.75	N
	LONGITUDE	103	35	27.62	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS

2. OPTIONAL

(2.5 ACRE)	(10 ACRE)	(40 ACRE)	(160 ACRE)	SECTION	TOWNSHIP	RANGE
¼	¼	¼	¼	8	24 ☐ NORTH ☑ SOUTH	33 ☑ EAST ☐ WEST

SUBDIVISION NAME	LOT NUMBER	BLOCK NUMBER	UNIT/TRACT

HYDROGRAPHIC SURVEY	MAP NUMBER	TRACT NUMBER

3. DRILLING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD #331	Phillip Stewart	Stewart Brothers Drilling Co.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
9/27/2012	10/21/2012	NA	1533 FT	NA

COMPLETED WELL IS: ☐ ARTESIAN ☑ DRY HOLE ☐ SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT): NA

DRILLING FLUID: ☐ AIR ☑ MUD ☐ ADDITIVES - SPECIFY: ETH GEL, PLATINUM PAC, BI-CARB, SODA ASH,

DRILLING METHOD: ☑ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER - SPECIFY: TACKLE, MYLOGEL, NaCl

DEPTH (FT) FROM	DEPTH (FT) TO	BORE HOLE DIA. (IN)	CASING MATERIAL	CONNECTION TYPE (CASING)	INSIDE DIA. CASING (IN)	CASING WALL THICKNESS (IN)	SLOT SIZE (IN)
0	1250	12.625	J-55 #36 steel	theaded	8.921	0.302	
1250	1533	8.75	NA				

4. WATER BEARING STRATA

DEPTH (FT) FROM	DEPTH (FT) TO	THICKNESS (FT)	FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	YIELD (GPM)
NA		NA	NA	NA

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA	TOTAL ESTIMATED WELL YIELD (GPM)
Bypass flow	na

FOR OSE INTERNAL USE — WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		PAGE 1 OF 2

5. SEAL AND PUMP

TYPE OF PUMP: ☐ SUBMERSIBLE ☐ JET ☑ NO PUMP – WELL NOT EQUIPPED ☐ TURBINE ☐ CYLINDER ☐ OTHER – SPECIFY:

ANNULAR SEAL AND GRAVEL PACK	DEPTH (FT) FROM	DEPTH (FT) TO	BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	AMOUNT (CUBIC FT)	METHOD OF PLACEMENT
	NA		NA	NA	NA	NA

6. GEOLOGIC LOG OF WELL

DEPTH (FT) FROM	DEPTH (FT) TO	THICKNESS (FT)	COLOR AND TYPE OF MATERIAL ENCOUNTERED (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	WATER BEARING?
0	20	20	Caliche	☐ YES ☑ NO
20	55	35	Gutuna Fm. - red siltstones and sandstones	☐ YES ☑ NO
55	1227	1181	Dewey Lake Fm.Red siltstones and mudstones, gray/green mottling	☐ YES ☑ NO
1227	1262	35	Rustler Fm./A-5, white anhydrite	☐ YES ☑ NO
1262	1295	33	H-4 sub-mbr. - milky white halite	☐ YES ☑ NO
1295	1310	15	A-4 sub-mbr. - white anhydrite	☐ YES ☑ NO
1310	1330	20	Magenta Dolomite	☐ YES ☑ NO
1330	1375	45	A-3 sub-mbr. white anhydrite	☐ YES ☑ NO
1375	1479	112	H-3 sub-mbr. - milky halite	☐ YES ☑ NO
1479	1489	10	Ore zone, anhydrite and white polyhalite	☐ YES ☑ NO
1489	1533	44	Halite, with some anhydrite	☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO

ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL

7. TEST & ADDITIONAL INFO

WELL TEST — METHOD: ☐ BAILER ☐ PUMP ☐ AIR LIFT ☐ OTHER – SPECIFY: NA

TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

ADDITIONAL STATEMENTS OR EXPLANATIONS:

8. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rusty D. Hurd — SIGNATURE OF DRILLER

12-10-12 — DATE

FOR OSE INTERNAL USE — WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		PAGE 2 OF 2

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO
2013 APR -2 P 1:25

1. GENERAL AND WELL LOCATION

POD NUMBER (WELL NUMBER)	OSE FILE NUMBER(S)
ICP-092	C - 03565 POD 8
WELL OWNER NAME(S)	**PHONE (OPTIONAL)**
Intercontinental Potash (USA)	575-942-2799
WELL OWNER MAILING ADDRESS	**CITY / STATE / ZIP**
600 West Bender Boulevard	Hobbs / NM / 88240

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32	13	8.17	N
	LONGITUDE	103	33	44.19	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS

2. OPTIONAL

(2.5 ACRE)	(10 ACRE)	(40 ACRE)	(160 ACRE)	SECTION	TOWNSHIP	RANGE
¼	¼	¼	¼	15	24 ☐ NORTH ☑ SOUTH	33 ☑ EAST ☐ WEST

SUBDIVISION NAME	LOT NUMBER	BLOCK NUMBER	UNIT/TRACT

HYDROGRAPHIC SURVEY	MAP NUMBER	TRACT NUMBER

3. DRILLING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD #331	Phillip Stewart	Stewart Brothers Drilling Co.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
02/19/2013	03/25/2013	NA	1665 FT	NA

COMPLETED WELL IS: ☐ ARTESIAN ☑ DRY HOLE ☐ SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ☐ AIR ☑ MUD ☐ ADDITIVES - SPECIFY: ETH GEL, PLATINUM PAC, BI-CARB, SODA ASH,

DRILLING METHOD: ☑ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER - SPECIFY: TACKLE, MYLOGEL, NaCl

DEPTH (FT) FROM	DEPTH (FT) TO	BORE HOLE DIA. (IN)	CASING MATERIAL	CONNECTION TYPE (CASING)	INSIDE DIA. CASING (IN)	CASING WALL THICKNESS (IN)	SLOT SIZE (IN)
0	1284	12.25	J-55 #20 steel	theaded	6.456	0.272	
1245	1665		NA				

4. WATER BEARING STRATA

DEPTH (FT) FROM	DEPTH (FT) TO	THICKNESS (FT)	FORMATION DESCRIPTION OF PRINCIPAL WATER-BEARING STRATA (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	YIELD (GPM)
NA		NA	NA	NA

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA	TOTAL ESTIMATED WELL YIELD (GPM)
Bypass flow	na

FOR OSE INTERNAL USE — WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER	C-3565	POD NUMBER	8	TRN NUMBER	509298
LOCATION	T24S - R~~33~~ 33E Section 15				PAGE 1 OF 2

5. SEAL AND PUMP

TYPE OF PUMP: ☐ SUBMERSIBLE ☐ JET ☑ NO PUMP – WELL NOT EQUIPPED ☐ TURBINE ☐ CYLINDER ☐ OTHER – SPECIFY:

STATE ENGINEER OFFICE ROSWELL

2013 APR -2 P

ANNULAR SEAL AND GRAVEL PACK	DEPTH (FT) FROM	TO	BORE HOLE DIA. (IN)	MATERIAL TYPE AND SIZE	AMOUNT (CUBIC FT)	METHOD OF PLACEMENT
	NA		NA	NA	NA	NA

6. GEOLOGIC LOG OF WELL

DEPTH (FT) FROM	TO	THICKNESS (FT)	COLOR AND TYPE OF MATERIAL ENCOUNTERED (INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES)	WATER BEARING?
0	20	20	Caliche	☐ YES ☑ NO
20	55	35	Gutuna Fm. - red siltstones and sandstones	☐ YES ☑ NO
55	1284	1229	Dewey Lake Fm.Red siltstones and mudstones, gray/green mottling	☐ YES ☑ NO
1284	1275	137	Rustler Fm./A-5, white anhydrite	☐ YES ☑ NO
1275	1306	31	H-4 sub-mbr. - milky white halite	☐ YES ☑ NO
1306	1320	14	A-4 sub-mbr. - white anhydrite	☐ YES ☑ NO
1320	1338	18	Magenta Dolomite	☐ YES ☑ NO
1338	1386	48	A-3 sub-mbr. white anhydrite	☐ YES ☑ NO
1386	1516	110	H-3 sub-mbr. - milky halite	☐ YES ☑ NO
1516	1526	10	Ore zone, anhydrite and white polyhalite	☐ YES ☑ NO
1526	1563	61	Halite and red mudstones	☐ YES ☐ NO
1563	1585	18	Anhydrite	☐ YES ☐ NO
1585	1606	31	Dolomite - Culebra	☐ YES ☐ NO
1606	1655	49	Halite, red mudstones H2/M2	☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO
				☐ YES ☐ NO

ATTACH ADDITIONAL PAGES AS NEEDED TO FULLY DESCRIBE THE GEOLOGIC LOG OF THE WELL

7. TEST, & ADDITIONAL INFO

WELL TEST — METHOD: ☐ BAILER ☐ PUMP ☐ AIR LIFT ☐ OTHER – SPECIFY: NA

TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

ADDITIONAL STATEMENTS OR EXPLANATIONS:

8. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Richard D. Stewart

SIGNATURE OF DRILLER — DATE

FOR OSE INTERNAL USE — WELL RECORD & LOG (Version 6/9/08)

FILE NUMBER C-3565	POD NUMBER 8	TRN NUMBER
LOCATION T24S - R~~33~~ 32E Sec 15		PAGE 2 OF 2

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
ROSWELL

Scott A. Verhines, P.E.
State Engineer

DISTRICT II
1900 West Second St.
Roswell, New Mexico 88201
Phone: (575) 622-6521
Fax: (575) 623-8559

April 18, 2013

Intercontinental Potash
Attn: Allen Hall
600 West Bender Boulevard
Hobbs, NM 88240

RE: *Well Logs* for C-3565 POD 8 and C-3565 POD 9

Greetings:

We have received and filed your Well Logs for the above referenced wells.

Sincerely,

Catherine Goetz
Water Resource Specialist
District II Office of the State Engineer

Enclosures
cc: Office of State Engineer, Santa Fe

Goetz, Catherine, OSE

From: Allen Hall [ahall@icpotash.com]
Sent: Monday, April 15, 2013 11:27 AM
To: Goetz, Catherine, OSE
Subject: RE: ICP-092 and ICP-093

Hi Catherine,

The borehole diameters for ICP092 and ICP093 were 12.25", from surface to casing depth, below casing 6.25". DST's were conducted on the Magenta mbr., and the Culebra mbr. In borehole ICP092, but not in ICP093. ICP had INTERA run the tests on the hydrology of these two mbrs., our concern was water from these units impacting the mine shaft in the furture. I need to contact Tim Dale at INTERA for the results of the Drill Stem Tests.

Thanks,

Allen

From: Goetz, Catherine, OSE [mailto:Catherine.Goetz@state.nm.us]
Sent: Monday, April 15, 2013 9:01 AM
To: Allen Hall
Subject: ICP-092 and ICP-093

Hi Mr. Hall,

Trying to get some items off the desk.
I received the Well Record and Log from the Stewart brothers for C-3565 POD 8 (ICP-092) and C-3565 POD9 (ICP-093).

Do you have the borehole diameters and if water bearing or not for the lower intervals for both wells?
ICP-092: 1245 to 1665 ft
ICP-093: 1245 to 1562.8 ft

Want to attach to well record so I can file these documents.
If you prefer, I'll contact Stewart Bros. for the info.

Thanks,
Cath Goetz

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Transwestern Pipeline Owner's Well No. SVE-13
Street or Post Office Address 6381 North Main Street
City and State Roswell, New Mexico 88201

Well was drilled under Permit No. N/A and is located in the:

a. SE ¼ NE ¼ ___ ¼ ___ ¼ of Section 1 Township 24S 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 Geoprojects International License No. WD 1311

Address 8834 Circle Drive Austin, TX 78736

Drilling Began 12/14/99 Completed 12/15/99 Type tools Air Rotary & HSA Size of hole 8 in.

Elevation of land surface or ___ at well is ___ ft. Total depth of well 99 ft.

Completed well is ☐ shallow ☐ artesian. Depth to water upon completion of well 90.4 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)
40	99	59	Red Sand	N/A

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Casing / Screen	Perforations From	Perforations To
2	0.69	4	0	84	84	SCH 40 PVC Casing	N/A	N/A
2	2.1	4	84	99	15	SCH 40 PVC Screen	84	99

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
1	78	8"	13.2	25.4	Pumped through HSA
78	81	8"	1.5 Bentonite Hole Plug	1	Surface Drop through HSA
81	99	8"	8/16 SAND	6	Surface Drop through HSA

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 01-31-2000

Quad ___ FWL ___ FSL ___

File No. ___ Use ___ Location No. 24S.33E.1.24

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	34.3	34.3	Sand, Tan. Brown to Red
34.3	36	2.3	Hard calcified Sandstone
40	99	59	Red Sand, Med. grained
			Clay hit @ 99

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 [illegible] except Section 5, shall be answered as completely and accurately [illegible]ssible when any well is drilled, repaired or deepene[illegible] this form is used as a plugging record, only Section 1(a) and Section [illegible]e completed.

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Transwestern Pipeline Owner's Well No. MW-13
Street or Post Office Address 6381 North Main Street
City and State Roswell, New Mexico 88201

Well was drilled under Permit No. N/A and is located in the:

a. SE ¼ NE ¼ ¼ ¼ of Section 1 Township 24S 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 Geoprobe Systems, International License No. WD 1311

Address 8034 Circle Drive Austin TX 78736

Drilling Began 12/14/99 Completed 12/14/99 Type tools Air Rotary & HSA Size of hole 8" in.

Elevation of land surface or _____ at well is _____ ft. Total depth of well 90 ft.

Completed well is ☐ shallow ☐ artesian. Depth to water upon completion of well 83.4 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	90	10	Red Sandstone	N/A
			H_2O @ 83.4'	

Section 3. RECORD OF CASING

OD JSWRB

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Casing / Screen	Perforations From	Perforations To
2	0.69	4	0	75	75	SCH 40 PVC	N/A	N/A
2	2.1	4	75	90	15	SCH 40 PVC	75	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
1	69	8"	11.5	22	Pumped through HSA
69	72	8"	1 Bentonite Hole Plug	1	Surface Drop through HSA
72	90	8"	8/16 Sand	6	Surface Drop through HSA

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 01-31-2000

Quad _____ FWL _____ FSL _____

File No. _____ Use _____ Location No. 24S.33E.1.24

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	34.3	34.3	Sand, Tan. Brown to Red
34.3	36	2.3	Hard calcified Sandstone
40	99	59	Red Sand, Med. grained
			Clay hit @ 99

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 [illegible] except Section 5, shall be answered as completely and accurately [illegible]ssible when any well is drilled, repaired or deepene[illegible] this form is used as a plugging record, only Section 1(a) and Section [illegible]e completed.

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

		OSE FILE NUMBER(S): C-3666
WELL OWNER NAME(S): AGAVE ENERGY COMPANY		PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 105 SOUTH 4TH STREET	CITY: ARTESIA	STATE: NM ZIP: 88210

WELL LOCATION (FROM GPS)		DEGREES	MINUTES	SECONDS	
	LATITUDE	32	12	49.3	N
	LONGITUDE	103	31	25.1	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS – PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1058	CASEY KEY	KEYS DRILLING & PUMP SERVICE INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
10-18-2013	10-26-2013	650	650	460

COMPLETED WELL IS: ☐ ARTESIAN ☐ DRY HOLE ☑ SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT): 390

DRILLING FLUID: ☑ AIR ☐ MUD ☐ ADDITIVES – SPECIFY:

DRILLING METHOD: ☑ ROTARY ☐ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY:

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	21	17-1/2"	STEEL		13-3/8"	.375	
-2.5	485	12-1/4"	STEEL	WELD	8"	.322	
485	650	12-1/4"	STEEL	WELD	8"	.322	.1875

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	20	17-1/2"	CEMENT		
0	325	12-1/4"	CEMENT		
325	390	12-1/4"	BENTONITE HOLE PLUG		
390	650	12-1/4"	5/8"GRAVEL		

STATE ENGINEER OFFICE ROSWELL, NM 2013 NOV 11 A 8:31

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3666	POD NUMBER	TRN NUMBER	532991
LOCATION	24S.33E.13	4-3-2		PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	10	10	TOP SOIL	☐ Y ■ N	
10	15	5	WHITE CALICHE	☐ Y ■ N	
15	50	35	RED SAND	☐ Y ■ N	
50	65	15	RED SANDSTONE	☐ Y ■ N	
65	90	25	GREY SAND AND CLAY	☐ Y ■ N	
90	97	7	DARK RED SANDSTONE	☐ Y ■ N	
97	100	3	GREY SANDSTONE	☐ Y ■ N	
100	108	8	DARK RED SANDSTONE	☐ Y ■ N	
108	117	9	GREY SAND AND CLAY	☐ Y ■ N	
117	123	6	DARK RED SANDSTONE	☐ Y ■ N	
123	155	41	GREY SANDSTONE	☐ Y ■ N	
155	160	5	DARK RED SANDSTONE	☐ Y ■ N	
160	195	35	GREY CLAY AND SAND	☐ Y ■ N	
195	210	15	DARK RED SANDSTONE	☐ Y ■ N	
210	230	20	GREY SANDSTONE	☐ Y ■ N	
230	300	70	RED SANDSTONE	☐ Y ■ N	
300	320	20	MULTI-COLOR SANDSTONE	☐ Y ■ N	
320	460	140	RED SANDSTONE	☐ Y ■ N	
460	465	5	MILTI-COLER ROCK	■ Y ☐ N	2-GPM
465	490	25	RED SANDSTONE	☐ Y ■ N	
490	535	45	MULTI-COLORED CONGLOMERATE	■ Y ☐ N	20-GPM

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ■ PUMP ☐ AIR LIFT ☐ BAILER ☐ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm): 38

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

535 TO 565 - 30 - RED SANDSTONE NO H2O
565 TO 600 - 35 - MULTI-COLORED CONGLOMERATE 25-GPM
600 TO 650 - 50 - RED SANDSTONE NO H2O

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

CASEY KEY

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Gary Key — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

11-13-13 — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): C-03662-POD1	OSE FILE NUMBER(S): C-03662
WELL OWNER NAME(S): MARK McCloy (M+M Ranch	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS:	CITY: STATE: ZIP:

WELL LOCATION (FROM GPS)

	DEGREES	MINUTES	SECONDS	
LATITUDE	32	12	29.00	N
LONGITUDE	103	32	33.81	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS – PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

Hwy 128 @ 30 mm - 1/4 mile south

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
1654	John Sirmen	Sirmen Drilling & Const

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
8/19/13	8/20/13	550'-0	550'-0	275'-0

COMPLETED WELL IS: ☐ ARTESIAN ☐ DRY HOLE ☑ SHALLOW (UNCONFINED)

STATIC WATER LEVEL IN COMPLETED WELL (FT): 110'-0

DRILLING FLUID: ☑ AIR ☐ MUD ☐ ADDITIVES – SPECIFY:

DRILLING METHOD: ☑ ROTARY ☑ HAMMER ☐ CABLE TOOL ☐ OTHER – SPECIFY:

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	280	10"	PVC	Certa-Lok	6"	DR-17	BLANK
280	360	10"	PVC	Certa Lok	6"	DR-17	.032 SLOT
360	500	10	PVC	Certa Lok	6"	DR-17	BLANK
500	550	10	PVC	Certa Lok	6"	DR-17	Screen

RECEIVED SEP 16 2013 STATE ENGINEER ROSWELL, NM

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT
0	20	10	3/8 hole plug - Bentonite	8 bags 50 lbs	gravity
20	550	10	3/8 pea gravel pack	5 yds	gravity

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	POD NUMBER	TRN NUMBER
C-3662		534516

LOCATION: Domestic/Stock 24S.33E.23.2-1-3

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	3	3	Brown Sand	☐Y ~~☑N~~	
3	30	27	caliche	☐Y ~~☑N~~	
30	40	10	Red sandstone	☐Y ~~☑N~~	
40	55	15	grey sandstone	☐Y ~~☑N~~	
55	65	10	Red shale	☐Y ~~☑N~~	
65	75	10	grey sandstone	☐Y ~~☑N~~	
75	250	175	Red shale	☐Y ~~☑N~~	
250	275	25	grey sandstone	~~☑Y~~ ☐N	7-10
275	550	275	Red shale	☐Y ~~☑N~~	
				☐Y ☐N	
				☐Y ☐N	
		550		☐Y ☐N	
				☐Y ☐N	
				☐Y ☐N	
				☐Y ☐N	
				☐Y ☐N	
				☐Y ☐N	
				☐Y ☐N	
				☐Y ☐N	
				☐Y ☐N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ☐ PUMP ☑ AIR LIFT ☐ BAILER ☐ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm): 7-10

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

none

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

none

STATE ENGINEER OFFICE ROSWELL, NM 2013 SEP 19 P 1:51

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

John Sisman — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

8/21/13 — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	POD NUMBER	TRN NUMBER
C-3662		534516

LOCATION 24S.33E.23.2-1-3

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSW

2013 JAN 29 A 2:21

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): BH 28	OSE FILE NUMBER(S): C3603; 518404
WELL OWNER NAME(S): INTERCONTINENTAL POTASH CORP	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 600 W. BENDER BLVD.	CITY: HOBBS STATE: NM ZIP: 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	10	30.4	N
LONGITUDE	103	32	58.5	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE: T24S; R 33E; SECTION 35

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-12-13	01-13-13		75'	N/A

STATIC WATER LEVEL IN COMPLETED WELL (FT):

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED)

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER - SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3603	POD NUMBER		TRN NUMBER	518404
LOCATION	24S.33E.35				PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	2	2	BROWN SILTY SAND, LOOSE	○ Y ◉ N	N/A
2	31	29	CALICHE WHITE SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
31	58	27	SHALE GREEN SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
58	75	17	SHALE RED SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
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				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

STATE ENGINEER OFFICE RECEIVED JAN 24 2013 AM

5. TEST; RIG SUPERVISION

WELL TEST: TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING.

Rodney Hammer — Rodney Hammer

SIGNATURE OF DRILLER / PRINT SIGNEE NAME

1-23-13

DATE

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROCK[illegible]

2013 JAN 29 A 2:24

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): BH 27	OSE FILE NUMBER(S): C3603; 518404
WELL OWNER NAME(S): INTERCONTINENTAL POTASH CORP	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 600 W. BENDER BLVD.	CITY: HOBBS STATE: NM ZIP: 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	10	20.0	N
LONGITUDE	103	32	18.8	W

* ACCURACY REQUIRED ONE TENTH OF A SECOND
* DATUM REQUIRED WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

T24S; R 33E; SECTION 35

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-14-13	01-14-13		75'	N/A

COMPLETED WELL IS ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES - SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER - SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06.08.2012)

FILE NUMBER	C-3603	POD NUMBER		TRN NUMBER	518404
LOCATION	24S.33E.35				PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	1	1	BROWN SILTY SAND, LOOSE	○ Y ◉ N	N/A
1	22	21	CALICHE WHITE SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
22	31	9	SHALE GREEN SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
31	70	39	SHALE RED SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
70	75	5	SHALE GRAY SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
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				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

STATE ENGINEER POD

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING.

Rodney Hammer — 1-23-13

SIGNATURE OF DRILLER / PRINT SIGNEE NAME — DATE

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL

2013 JAN 29 A 2:21

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): BH 26	OSE FILE NUMBER(S): C3603; 518404
WELL OWNER NAME(S): INTERCONTINENTAL POTASH CORP	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 600 W. BENDER BLVD.	CITY: HOBBS STATE: NM ZIP: 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	10	40.9	N
LONGITUDE	103	32	52.8	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE: T24S; R 33E; SECTION 35

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-13-13	01-13-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER – SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3603	POD NUMBER	TRN NUMBER	518404
LOCATION	24S.33E.35			PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	2	2	BROWN SILTY SAND, LOOSE	Y (•) N	N/A
2	23	21	CALICHE WHITE SILTY SAND, VERY DENSE	Y (•) N	N/A
23	31	8	RED SILTY SAND, VERY DENSE	Y (•) N	N/A
31	41	10	SHALE RED SILTY SAND, VERY DENSE	Y (•) N	N/A
41	75'	34	SHALE GREEN SILTY SAND, VERY DENSE	Y (•) N	N/A
				Y ( ) N	
				Y ( ) N	
				Y ( ) N	
				Y ( ) N	
				Y ( ) N	
				Y ( ) N	
				Y ( ) N	
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				Y ( ) N	
				Y ( ) N	
				Y ( ) N	
				Y ( ) N	

STATE ENGINEER
ROSWELL
2013 JAN 29 A 7:47

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ( ) PUMP ( ) AIR LIFT ( ) BAILER ( ) OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm)

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rodney Hammer — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

1-23-13 — DATE

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL

2013 JAN 29 A 2:21

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): BH 25	OSE FILE NUMBER(S): C3603; 518404
WELL OWNER NAME(S): INTERCONTINENTAL POTASH CORP	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 600 W. BENDER BLVD.	CITY: HOBBS STATE: NM ZIP: 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	10	43.1	N
LONGITUDE	103	32	33.9	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE: T24S; R 33E; SECTION 35

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-11-13	01-11-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER – SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3603	POD NUMBER		TRN NUMBER	518404
LOCATION	24S.33E.35				PAGE 1 OF 2

STATE ENGINEER OFFICE
2013 JAN 24 P 12:05

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	1	1	BROWN SILTY SAND, LOOSE	○ Y ◉ N	N/A
1	26	25	CALICHE WHITE SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
26	38	12	SHALE GREEN SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
38	46	8	SHALE RED SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
46	75	19	SHALE BROWN SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
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				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER - SPECIFY

TOTAL ESTIMATED WELL YIELD (gpm)

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD

MISCELLANEOUS INFORMATION

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING.

Rodney Hammer — 1-23-13

SIGNATURE OF DRILLER — PRINT SIGNEE NAME — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/30/11)

FILE NUMBER — POD NUMBER — TRN NUMBER

LOCATION — PAGE 2 OF 2

WELL RECORD & LOG

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STATE ENGINEER OFFICE
ROSWELL

2013 JAN 29 A 2:21

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): BH 29	OSE FILE NUMBER(S): C3603; 518404
WELL OWNER NAME(S): INTERCONTINENTAL POTASH CORP	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 600 W. BENDER BLVD.	CITY: HOBBS STATE: NM ZIP: 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	10	20.0	N
LONGITUDE	103	32	58.5	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS – PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE: T24S; R 33E; SECTION 35

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-13-13	01-13-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER – SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE

FILE NUMBER	C-3603	POD NUMBER	TRN NUMBER	518404
LOCATION	24S.33E.35			

WR-20 WELL RECORD & LOG (Version 06/08/2012)

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	1	1	BROWN SILTY SAND, LOOSE	N	N/A
1	13	12	CALICHE WHITE SILTY SAND, VERY DENSE	N	N/A
13	24	11	RED SAND STONE	N	N/A
24	35	1	SHALE RED SILTY SAND, VERY DENSE	N	N/A
35	75	40	SHALE GREEN SILTY SAND, VERY DENSE	N	N/A

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ◯ PUMP ◯ AIR LIFT ◯ BAILER ◯ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm)

5. TEST; RIG SUPERVISION

WELL TEST: TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING

[signature] Rodney Hammer — 1-23-13

SIGNATURE OF DRILLER / PRINT SIGNEE NAME — DATE

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
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2013 JUN 29 A 2:34

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): BH 24	OSE FILE NUMBER(S): C3603; 518404
WELL OWNER NAME(S): INTERCONTINENTAL POTASH CORP	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 600 W. BENDER BLVD.	CITY: HOBBS STATE: NM ZIP: 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	10	44.8	N
LONGITUDE	103	32	17.8	W

* ACCURACY REQUIRED ONE TENTH OF A SECOND
* DATUM REQUIRED WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE: T24S; R 33E; SECTION 35

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-10-13	01-10-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER – SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3603	POD NUMBER		TRN NUMBER	518404
LOCATION	24S.33E.35				PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	2	2	BROWN SILTY SAND, LOOSE	○ Y ◉ N	N/A
2	23	21	CALICHE WHITE SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
23	40	17	SHALE GREEN SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
40	75	5	SHALE RED SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER – SPECIFY

TOTAL ESTIMATED WELL YIELD (gpm)

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING.

Rodney Hammer — Rodney Hammer — 1-23-13

SIGNATURE OF DRILLER / PRINT SIGNEE NAME — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	POD NUMBER	TRN NUMBER
LOCATION		PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): BH 14	OSE FILE NUMBER(S): C3601; 518393
WELL OWNER NAME(S): INTERCONTINENTAL POTASH CORP	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 600 W. BENDER BLVD.	CITY: HOBBS STATE: NM ZIP: 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	11	47.9	N
LONGITUDE	103	32	11.4	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND

* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE: T24S; R 33E; SECTION 23

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-05-13	01-05-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES - SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER - SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

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3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3601	POD NUMBER	7	TRN NUMBER	518393
LOCATION	T24S-R33E-Sec 23.441				PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	2	2	BROWN SILTY SAND, LOOSE	○ Y ◉ N	N/A
2	27	25	CALICHE WHITE SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
27	47	20	SHALE RED SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
47	75'	28	SHALE GREEN SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

STATE ENGINEER OFFICE
ROSWELL, NM
2013 JAN 30 P 1:00

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rodney Hammer — 1-23-13

SIGNATURE OF DRILLER / PRINT SIGNEE NAME — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3601	POD NUMBER	7	TRN NUMBER	
LOCATION	T24S - R33E - Sec 23.441				PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 30 P 10:44

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER)	OSE FILE NUMBER(S)
BH 13	C3601; 518393
WELL OWNER NAME(S): INTERCONTINENTAL POTASH CORP	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 600 W. BENDER BLVD.	CITY: HOBBS STATE: NM ZIP: 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	11	53.4	N
LONGITUDE	103	32	15.6	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

T24S; R 33E; SECTION 23

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-05-13	01-05-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES - SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER - SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3601	POD NUMBER	6	TRN NUMBER	518393
LOCATION	T24S - R33E - Section 23.441				PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	2	2	BROWN SILTY SAND, LOOSE	○ Y ◉ N	N/A
2	24	22	CALICHE WHITE SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
24	46	22	RED SILTY SAND, DENSE TO VERY DENSE	○ Y ◉ N	N/A
46	74	28	SHALE GREEN SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
74	75	1	SHALE RED SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
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				○ Y ○ N	
				○ Y ○ N	
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				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	

STATE ENGINEER OFFICE ROSWELL 2013 JAN 30 P 1:04

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rodney Hammer — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

1-23-13 — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3601	POD NUMBER	6	TRN NUMBER	
LOCATION	T24S - R33E - Section 23.441				PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 30 P 10:44

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): BH 12	OSE FILE NUMBER(S): C3601; 518393
WELL OWNER NAME(S): INTERCONTINENTAL POTASH CORP	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 600 W. BENDER BLVD.	CITY: HOBBS STATE: NM ZIP: 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	11	53.2	N
LONGITUDE	103	32	9.7	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE: T24S; R 33E; SECTION 23

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-06-13	01-06-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER – SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3601	POD NUMBER	5	TRN NUMBER	518393
LOCATION	T24S — R33E — Section 23. 442				PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	1	2	BROWN SILTY SAND, LOOSE	○ Y ◉ N	N/A
1	19	18	CALICHE WHITE SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
19	31	12	RED SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
31	38	7	SHALE GREEN SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
38	75	37	SHALE RED SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
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				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

STATE ENGINEER OFFICE RECEIVED JAN 30 2013 ROSWELL

5. TEST; RIG SUPERVISION

WELL TEST: TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rodney Hammer — 1-23-13

SIGNATURE OF DRILLER / PRINT SIGNEE NAME — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3601	POD NUMBER	5	TRN NUMBER	
LOCATION	T24S – R33E – Section 23.442				PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL NEW MEXICO

2013 JAN 30 P 10:41

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): BH 11	OSE FILE NUMBER(S): C3601;518393
WELL OWNER NAME(S): INTERCONTINENTAL POTASH CORP	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 600 W. BENDER BLVD.	CITY: HOBBS STATE: NM ZIP: 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	10	49.5	N
LONGITUDE	103	32	4.1	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

T24S; R 33E; SECTION 24

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-03-13	01-04-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED)

STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER – SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75'	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3601	POD NUMBER	4	TRN NUMBER	518393
LOCATION	T 24S - R 33E - Section 24, 333				PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	3	3	LIGHT BROWN SILTY SAND. VERY LOOSE	○ Y ◉ N	N/A
3	8"	5	CALICHE WHITE SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
8"	35	27	LIGHT RED SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
35	75	40	LIGHT GREEN SILTY SAND, SHALE VERY DENSE	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
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				○ Y ○ N	
				○ Y ○ N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

5. TEST; RIG SUPERVISION

WELL TEST: TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

STATE ENGINEER OFFICE ROSWELL 2013 JAN 30 P

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rodney Hammer — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

1-23-13 — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3601	POD NUMBER	4	TRN NUMBER	
LOCATION	T24S-R33E-Section 24.333				PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 30 P 10:40

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): BH 10	OSE FILE NUMBER(S): C3601; 518393
WELL OWNER NAME(S): INTERCONTINENTAL POTASH CORP	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 600 W. BENDER BLVD.	CITY: HOBBS STATE: NM ZIP: 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	11	55.7	N
LONGITUDE	103	32	3.8	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

T245; R 33E; SECTION 23

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-06-13	01-06-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED)

STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES - SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER - SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3601	POD NUMBER 3	TRN NUMBER 518393
LOCATION T24S - R33E - Section 24. 331		PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	3	3	BROWN SILTY SAND, LOOSE	◯ Y ● N	N/A
3	19	16	CALICHE WHITE SILTY SAND, VERY DENSE	◯ Y ● N	N/A
19	31	12	RED SILTY SAND, VERY DENSE	◯ Y ● N	N/A
31	42	11	SHALE GREEN SILTY SAND, VERY DENSE	◯ Y ● N	N/A
42	57	15	SHALE RED SILTY SAND, VERY DENSE	◯ Y ● N	N/A
57	75	18	SHALE GREEN SILTY SAND, VERY DENSE	◯ Y ● N	N/A
				◯ Y ◯ N	
				◯ Y ◯ N	
				◯ Y ◯ N	
				◯ Y ◯ N	
				◯ Y ◯ N	
				◯ Y ◯ N	
				◯ Y ◯ N	
				◯ Y ◯ N	
				◯ Y ◯ N	
				◯ Y ◯ N	
				◯ Y ◯ N	
				◯ Y ◯ N	
				◯ Y ◯ N	
				◯ Y ◯ N	
				◯ Y ◯ N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ◯ PUMP ◯ AIR LIFT ◯ BAILER ◯ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

5. TEST; RIG SUPERVISION

WELL TEST: TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

[signature] Rodney Hammer — 1-28-13

SIGNATURE OF DRILLER / PRINT SIGNED NAME — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3601	POD NUMBER 3	TRN NUMBER
LOCATION T24S - R33E - Section 24.331		PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 30 P 10: 39

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER)	OSE FILE NUMBER(S)
BH 9	C3601; 518393
WELL OWNER NAME(S)	PHONE (OPTIONAL)
INTERCONTINENTAL POTASH CORP	
WELL OWNER MAILING ADDRESS	CITY / STATE / ZIP
600 W. BENDER BLVD.	HOBBS / NM / 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	12	1.5	N
LONGITUDE	103	32	15.0	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

T245; R 33E; SECTION 23

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-06-13	01-07-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER – SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3601	POD NUMBER	2	TRN NUMBER	518393
LOCATION	T24S-R33E-Sec 23.423				PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	1	1	BROWN SILTY SAND, LOOSE	○ Y ◉ N	N/A
1	23	22	CALICHE WHITE SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
23	75	52	SHALE GREEN SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

STATE ENGINEER OFFICE ROSWELL, NM RECEIVED JAN 30 P 12:40

5. TEST; RIG SUPERVISION

WELL TEST: TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rodney Hammer — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

1-23-13 — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3601	POD NUMBER	2	TRN NUMBER	
LOCATION	T24S-R33E-Sec 23.423				PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN -8 A 11:51

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER)	OSE FILE NUMBER(S)
BH8	C-03601 : 518393
WELL OWNER NAME(S)	PHONE (OPTIONAL)
INTERCONTINENTAL POTASH CORP	
WELL OWNER MAILING ADDRESS	CITY / STATE / ZIP
600 W. BENDER BLVD.	HOBBS / NM / 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	12	12.7	N
LONGITUDE	103	32	4.2	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

T24S; R 33E; SECTION 24

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
12-21-12	12-21-12		100'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED)

STATIC WATER LEVEL IN COMPLETED WELL (FT)

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER – SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	100	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3601	POD NUMBER	/	TRN NUMBER	518393
LOCATION	24S-33E-24.1333				PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	2	2	DARK BROWN SILTY SAND, LOOSE SLIGHTLY DAMP	○ Y ◉ N	N/A
2	28	26	CALICHE WHITE, VERY DENSE, SLIGHTLY DAMP	○ Y ◉ N	N/A
28	46	18	CALICHE REDISH BROWN, VERY DENSE, SLIGHTLY DAMP	○ Y ◉ N	N/A
46	100	54	CALICHE GREENISH BROWN, VERY DENSE, SLIGHTLY DAMP	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	

STATE ENGINEER OFFICE ROSWELL, NM 2013 JAN -8 A 11:55

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rodney Hammer — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

1-7-13 — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3601	POD NUMBER	1	TRN NUMBER	
LOCATION	24S-33E-24.1333				PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 29 P 2:21

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): BH 23	OSE FILE NUMBER(S): C3600; 518382
WELL OWNER NAME(S): INTERCONTINENTAL POTASH CORP	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 600 W. BENDER BLVD.	CITY: HOBBS STATE: NM ZIP: 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	11	9.4	N
LONGITUDE	103	32	58.6	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE: T24S; R 33E; SECTION 26

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-08-13	01-09-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES - SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER - SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3600 | POD NUMBER BH-23 | TRN NUMBER 518382

LOCATION

STATE ENGINEER OFFICE
ROSWELL
2013 JAN 24 P 12:21

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	2	2	BROWN SILTY SAND, LOOSE	○ Y ◉ N	N/A
2	24	22	CALICHE WHITE SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
24	66	42	RED SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
66	75	9	SHALE GREEN SILTY SAND	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

5. TEST; RIG SUPERVISION

WELL TEST: TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rodney Hammer — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

1-23-13 — DATE

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3600	POD NUMBER	BH-23	TRN NUMBER	518382
LOCATION					PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

www.ose.state.nm.us

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO
2013 JAN 29 P 2:21

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): BH 22	OSE FILE NUMBER(S): C3600; 518382
WELL OWNER NAME(S): INTERCONTINENTAL POTASH CORP	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 600 W. BENDER BLVD.	CITY: HOBBS STATE: NM ZIP: 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	11	11.0	N
LONGITUDE	103	32	33.5	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE: T24S; R 33E; SECTION 26

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-09-13	01-09-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES - SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER - SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3600	POD NUMBER BH-22	TRN NUMBER 518382
LOCATION		PAGE 1 OF 2

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO
2013 JAN 29 AM 8:20

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	2	2	BROWN SILTY SAND, LOOSE	○ Y ◉ N	N/A
2	27	25	CALICHE WHITE SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
27	42	15	RED SILTY SAND, DENSE TO VERY DENSE	○ Y ◉ N	N/A
42	75	33	SHALE RED SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rod Hamm — Rodney Hammer — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

1-23-13 — DATE

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3600	POD NUMBER	BH-22	TRN NUMBER	518382
LOCATION					PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 29 P 2:21

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER)	OSE FILE NUMBER(S)
BH 21	C3600; 518382
WELL OWNER NAME(S)	**PHONE (OPTIONAL)**
INTERCONTINENTAL POTASH CORP	
WELL OWNER MAILING ADDRESS	**CITY / STATE / ZIP**
600 W. BENDER BLVD.	HOBBS / NM / 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	11	10.6	N
LONGITUDE	103	32	15.4	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

T24S; R 33E; SECTION 26

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-09-13	01-09-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD — ADDITIVES - SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER - SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-31690 | POD NUMBER BH-21 | TRN NUMBER 518382

LOCATION

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO
2013 JAN 29 P 2:30

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	2	2	BROWN SILTY SAND, LOOSE	○ Y ◉ N	N/A
2	17	15	CALICHE WHITE SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
17	28	11	SHALE GREEN SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
28	75	47	SHALE RED SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

5. TEST; RIG SUPERVISION

WELL TEST: TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rodney Hammer — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

1-23-13 — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3600	POD NUMBER BH-21	TRN NUMBER 518382
LOCATION		PAGE 2 OF 2

WELL RECORD & LOG

OFFICE OF THE STATE ENGINEER

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1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER)	OSE FILE NUMBER(S)
BH 20	C3600; 518382
WELL OWNER NAME(S)	PHONE (OPTIONAL)
INTERCONTINENTAL POTASH CORP	
WELL OWNER MAILING ADDRESS	CITY / STATE / ZIP
600 W. BENDER BLVD.	HOBBS / NM / 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	11	20.0	N
LONGITUDE	103	33	2.6	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

T24S; R 33E; SECTION 26

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-08-13	01-08-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES - SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER - SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3600	POD NUMBER BH-20	TRN NUMBER 518382
LOCATION		PAGE 1 OF 2

STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 24 P 2: 24

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	2	2	BROWN SILTY SAND, LOOSE	N	N/A
2	17	15	CALICHE WHITE SILTY SAND, VERY DENSE	N	N/A
17	63	46	RED SILTY SAND, DENSE TO VERY DENSE	N	N/A
63	68	5	SHALE RED SILTY SAND, VERY DENSE	N	N/A
68	75	7	RED SAND STONE	N	N/A
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	
				Y / N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ◯ PUMP ◯ AIR LIFT ◯ BAILER ◯ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

5. TEST; RIG SUPERVISION

WELL TEST: TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

[signature] Rodney Hammer — 1-23-13

SIGNATURE OF DRILLER / PRINT SIGNEE NAME — DATE

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3600	POD NUMBER BH-20	TRN NUMBER 518382
LOCATION		

WELL RECORD & LOG

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO
2013 JAN 29 P 2:21

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): 8H 19	OSE FILE NUMBER(S): C3600; 518382
WELL OWNER NAME(S): INTERCONTINENTAL POTASH CORP	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 600 W. BENDER BLVD.	CITY: HOBBS STATE: NM ZIP: 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	11	21.0	N
LONGITUDE	103	32	18.0	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE: T24S; R 33E; SECTION 26

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-16-13	01-16-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED)

STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES - SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER - SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3600 | POD NUMBER BH-19 | TRN NUMBER 518382

LOCATION

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	2	2	BROWN SILTY SAND, LOOSE	( ) Y (•) N	N/A
2	13	11	CALICHE WHITE SILTY SAND, VERY DENSE	( ) Y (•) N	N/A
13	28	15	RED SILTY SAND. VERY DENSE	( ) Y (•) N	N/A
28	38	10	SHALE RED SILTY SAND, VERY DENSE	( ) Y (•) N	N/A
38	75	37	SHALE GREEN SILTY SAND, VERY DENSE	( ) Y (•) N	N/A
				( ) Y ( ) N	
				( ) Y ( ) N	
				( ) Y ( ) N	
				( ) Y ( ) N	
				( ) Y ( ) N	
				( ) Y ( ) N	
				( ) Y ( ) N	
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				( ) Y ( ) N	
				( ) Y ( ) N	
				( ) Y ( ) N	
				( ) Y ( ) N	
				( ) Y ( ) N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ( ) PUMP ( ) AIR LIFT ( ) BAILER ( ) OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

STATE ENGINEER OFFICE ROSWELL, N.M. 2013 JAN 29 P 2:21

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rodney Hammer — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

1-23-13 — DATE

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3600	POD NUMBER BH-19	TRN NUMBER 514382
LOCATION		PAGE 2 OF 2

WELL RECORD & LOG

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 29 P 2:21

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER)	OSE FILE NUMBER(S)
BH 18	C3682; 518347
WELL OWNER NAME(S)	**PHONE (OPTIONAL)**
INTERCONTINENTAL POTASH CORP	
WELL OWNER MAILING ADDRESS	**CITY / STATE / ZIP**
600 W. BENDER BLVD.	HOBBS / NM / 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	11	20.2	N
LONGITUDE	103	31	38.3	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE

T24S; R 33E; SECTION 25

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-15-13	01-15-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER – SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3600	POD NUMBER BH-18	TRN NUMBER 518382
LOCATION		PAGE 1 OF 2

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	1	1	BROWN SILTY SAND, LOOSE	○ Y ◉ N	N/A
1	21	20	CALICHE WHITE SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
21	47	76	SHALE GREEN SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
47	53	6	SHALE RED SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
53	75	22	SHALE GREEN SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
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				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	

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METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rodney Hammer — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

1-23-13 — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3600	POD NUMBER BH-18	TRN NUMBER 518382
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WELL RECORD & LOG

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STATE ENGINEER OFFICE
ROSWELL, NEW MEXICO

2013 JAN 29 P 2:20

1. GENERAL AND WELL LOCATION

OSE POD NUMBER (WELL NUMBER): BH 17	OSE FILE NUMBER(S): C3600; 518382
WELL OWNER NAME(S): INTERCONTINENTAL POTASH CORP	PHONE (OPTIONAL):
WELL OWNER MAILING ADDRESS: 600 W. BENDER BLVD.	CITY: HOBBS STATE: NM ZIP: 88240

WELL LOCATION (FROM GPS)	DEGREES	MINUTES	SECONDS	
LATITUDE	32	11	20.2	N
LONGITUDE	103	31	38.3	W

* ACCURACY REQUIRED: ONE TENTH OF A SECOND
* DATUM REQUIRED: WGS 84

DESCRIPTION RELATING WELL LOCATION TO STREET ADDRESS AND COMMON LANDMARKS - PLSS (SECTION, TOWNSHIP, RANGE) WHERE AVAILABLE: T24S; R 33E; SECTION 26

2. DRILLING & CASING INFORMATION

LICENSE NUMBER	NAME OF LICENSED DRILLER	NAME OF WELL DRILLING COMPANY
WD-1186	RODNEY HAMMER	ENVIRO-DRILL, INC.

DRILLING STARTED	DRILLING ENDED	DEPTH OF COMPLETED WELL (FT)	BORE HOLE DEPTH (FT)	DEPTH WATER FIRST ENCOUNTERED (FT)
01-07-13	01-08-13		75'	N/A

COMPLETED WELL IS: ( ) ARTESIAN (•) DRY HOLE ( ) SHALLOW (UNCONFINED) — STATIC WATER LEVEL IN COMPLETED WELL (FT):

DRILLING FLUID: ( ) AIR ( ) MUD ADDITIVES – SPECIFY:

DRILLING METHOD: ( ) ROTARY ( ) HAMMER ( ) CABLE TOOL (•) OTHER – SPECIFY: AUGER

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM (inches)	CASING MATERIAL AND/OR GRADE (include each casing string, and note sections of screen)	CASING CONNECTION TYPE	CASING INSIDE DIAM. (inches)	CASING WALL THICKNESS (inches)	SLOT SIZE (inches)
0	75	8"	N/A	N/A	N/A	N/A	N/A

3. ANNULAR MATERIAL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	BORE HOLE DIAM. (inches)	LIST ANNULAR SEAL MATERIAL AND GRAVEL PACK SIZE-RANGE BY INTERVAL	AMOUNT (cubic feet)	METHOD OF PLACEMENT

FOR OSE INTERNAL USE

WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER C-3600 | POD NUMBER BH-17 | TRN NUMBER 518382

LOCATION

STATE ENGINEER OFFICE
ROSWELL, NM
2013 JAN 24 P 2:20

4. HYDROGEOLOGIC LOG OF WELL

DEPTH (feet bgl) FROM	DEPTH (feet bgl) TO	THICKNESS (feet)	COLOR AND TYPE OF MATERIAL ENCOUNTERED - INCLUDE WATER-BEARING CAVITIES OR FRACTURE ZONES (attach supplemental sheets to fully describe all units)	WATER BEARING? (YES / NO)	ESTIMATED YIELD FOR WATER-BEARING ZONES (gpm)
0	2	2	BROWN SILTY SAND, LOOSE	○ Y ◉ N	N/A
2	18	16	CALICHE WHITE SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
18	24	6	RED SILTY SAND, DENSE TO VERY DENSE	○ Y ◉ N	N/A
24	33	9	RED SAND STONE	○ Y ◉ N	N/A
33	50	17	SHALE GREEN SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
50	75	25	SHALE RED SILTY SAND, VERY DENSE	○ Y ◉ N	N/A
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	
				○ Y ○ N	

METHOD USED TO ESTIMATE YIELD OF WATER-BEARING STRATA: ○ PUMP ○ AIR LIFT ○ BAILER ○ OTHER – SPECIFY:

TOTAL ESTIMATED WELL YIELD (gpm):

5. TEST; RIG SUPERVISION

WELL TEST — TEST RESULTS - ATTACH A COPY OF DATA COLLECTED DURING WELL TESTING, INCLUDING DISCHARGE METHOD, START TIME, END TIME, AND A TABLE SHOWING DISCHARGE AND DRAWDOWN OVER THE TESTING PERIOD.

MISCELLANEOUS INFORMATION:

PRINT NAME(S) OF DRILL RIG SUPERVISOR(S) THAT PROVIDED ONSITE SUPERVISION OF WELL CONSTRUCTION OTHER THAN LICENSEE:

6. SIGNATURE

THE UNDERSIGNED HEREBY CERTIFIES THAT, TO THE BEST OF HIS OR HER KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT RECORD OF THE ABOVE DESCRIBED HOLE AND THAT HE OR SHE WILL FILE THIS WELL RECORD WITH THE STATE ENGINEER AND THE PERMIT HOLDER WITHIN 20 DAYS AFTER COMPLETION OF WELL DRILLING:

Rod Hammer — Rodney Hammer — SIGNATURE OF DRILLER / PRINT SIGNEE NAME

1-23-13 — DATE

FOR OSE INTERNAL USE — WR-20 WELL RECORD & LOG (Version 06/08/2012)

FILE NUMBER	C-3600	POD NUMBER	BH-17	TRN NUMBER	518382
LOCATION					PAGE 2 OF 2

ATTACHMENT II.9.C
VADOSE ZONE MONITORING FORM

ATTACHMENT II.9.C

Vadose Zone Monitoring Form (Typical)

OWL Landfill Services, LLC

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)	Hydrogen Sulfide Gas (%)		Y	N	
VZ-1											
VZ-2											
VZ-3											
VZ-4											
VZ-5											

Notes:

- *fmsl: feet above mean sea level*
- *fbtoc: feet below top of PVC casing*

Established in 1960, Golder Associates is a global, employee-owned organization that helps clients find sustainable solutions to the challenges of finite resources, energy and water supply and management, waste management, urbanization, and climate change. We provide a wide range of independent consulting, design, and construction services in our specialist areas of earth, environment, and energy. By building strong relationships and meeting the needs of clients, our people have created one of the most trusted professional services organizations in the world.

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Golder Associates

Engineering Earth's Development, Preserving Earth's Integrity