AE Order Number Banner

Report Description

This report shows an AE Order Number in Barcode format for purposes of scanning. The Barcode format is Code 39.

App Number: pCS1828842329

3RF - 29

ENDURING RESOURCES, LLC

10/19/2018

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

Form C-147
Revised April 3, 2017

3RF-29

Recycling Facility and/or Recycling Containment

Type of Facility: [X] Recycling Facility [X] Recycling Containment*

Type of action: [X] Permit [X] Registration
[ ] Modification [ ] Extension
[ ] Closure [ ] Other (explain) _____

*** At the time C-147 is submitted to the division for a Recycling Containment, a copy shall be provided to the surface owner.**

Be advised that approval of this request does not relieve the operator of liability should operations result in pollution of surface water, ground water or the environment. Nor does approval relieve the operator of its responsibility to comply with any other applicable governmental authority's rules, regulations or ordinances.

1.
Operator: Enduring Resources IV, LLC (For multiple operators attach page with information) OGRID #: 372286
Address: 200 Energy Court, Farmington, NM 87401
Facility or well name (include API# if associated with a well): WLU 2309-24N
OCD Permit Number: _____ (For new facilities the permit number will be assigned by the district office)
U/L or Qtr/Qtr SE/4 SW/4 & SW/4 Section 24 Township 23N Range 9W County: San Juan
Surface Owner: [X] Federal [ ] State [ ] Private [ ] Tribal Trust or Indian Allotment

2.
[X] **Recycling Facility:**
Location of recycling facility (if applicable): Latitude 36.205958 Longitude -107.740891 NAD83
Proposed Use: [X] Drilling* [X] Completion* [X] Production* [X] Plugging *
The re-use of produced water may NOT be used until fresh water zones are cased and cemented
[ ] Other, ***requires permit for other uses. Describe use, process, testing, volume of produced water and ensure there will be no adverse impact on groundwater or surface water.***
[X] Fluid Storage
[X] Above ground tanks [X] Recycling containment [ ] Activity permitted under 19.15.17 NMAC explain type _____
[ ] Activity permitted under 19.15.36 NMAC explain type: _____ [ ] Other explain _____
[ ] For multiple or additional recycling containments, attach design and location information of each containment
[ ] **Closure Report (required within 60 days of closure completion):** [ ] Recycling Facility Closure Completion Date: _____

NMOCD
OCT 17 2018
DISTRICT III

3.
[X] **Recycling Containment:**
[ ] Annual Extension after initial 5 years (attach summary of monthly leak detection inspections for previous year)
Center of Recycling Containment (if applicable): Latitude 36.205958 Longitude -107.740891 NAD83
[ ] For multiple or additional recycling containments, attach design and location information of each containment
[X] Lined [ ] Liner type: Thickness 45 mil [X] LLDPE [ ] HDPE [ ] PVC [ ] Other _____
[X] String-Reinforced
Liner Seams: [X] Welded [X] Factory [ ] Other _____ Volume: 265,385 bbl Dimensions: L 350' x W 400' x D 25'
[ ] Recycling Containment Closure Completion Date: _____

Smith, Cory, EMNRD

From: Smith, Cory, EMNRD
Sent: Friday, October 19, 2018 10:48 AM
To: 'Andrea Felix'
Cc: Fields, Vanessa, EMNRD
Subject: RE: WLU 2309-24N Assigned 3RF-29

Good Morning Andrea,

OCD has received the C-147 for the Recycling containment at the Enduring WLU 2309-24N on October 17, 2018. Upon further review the application has been approved with the following conditions of approval.

- Enduring will notify the OCD District III at least 48 hours but no more than 1 week prior to the start of construction of the pond.
- Enduring will notify the OCD District III at least 48 hours but no more than 1 week at the completion of the leak detection prior to being covered by any sand/liner.

Enduring may find the approved permit application (once scanned) by searching for 3RF-29 in OCD Online. Please remember Enduring will need the Admin # to report on Form C-148 monthly for all Recycling facilities.

If you have any additional questions please give me a call.

Thank you,

Cory Smith
Environmental Specialist
Oil Conservation Division
Energy, Minerals, & Natural Resources
1000 Rio Brazos, Aztec, NM 87410
(505)334-6178 ext 115
cory.smith@state.nm.us

From: Smith, Cory, EMNRD
Sent: Monday, October 15, 2018 11:33 AM
To: 'Andrea Felix' <AFelix@enduringresources.com>
Cc: Fields, Vanessa, EMNRD <Vanessa.Fields@state.nm.us>
Subject: WLU 2309-24N Assigned 3RF-29

Good morning Andrea,

OCD has received the C-147 for the Recycling containment at the Enduring WLU 2309-24N on October 4, 2018. Upon further review the application is incomplete and has been denied for the following

- The design plan needs to state how the pond is designed to prevent surface water run on.
- The design plan needs to state how the pond inside Levey grade is no steeper than 2H:1V grade
- The design plan needs to state how the ponds outside Levey grade is no steeper than 3H:1V grade.

- The design plan needs to state/describe how the liner is protected from fluid force or mechanical damage
- The primary Liner must be resistant to UV light, petroleum hydrocarbons, salt and acidic/alkaline solutions.
- In the closure plan, the operator shall notify the OCD when reclamation and revegetation are completed.

Please correct the above issues and resubmit a complete and correct registration. Since this application has no API# for record keeping I have assigned it to 3RF-29 the denied application will be scanned into the online file as soon as possible.

If you have any questions please give me a call.

Thanks,

Cory Smith
Environmental Specialist
Oil Conservation Division
Energy, Minerals, & Natural Resources
1000 Rio Brazos, Aztec, NM 87410
(505)334-6178 ext 115
cory.smith@state.nm.us

4.

Bonding:

☒ Covered under bonding pursuant to 19.15.8 NMAC per 19.15.34.15(A)(2) NMAC **(These containments are limited to only the wells owned or operated by the owners of the containment.)**

☐ Bonding in accordance with 19.15.34.15(A)(1). Amount of bond $_____ **(work on these facilities cannot commence until bonding amounts are approved)**

☐ Attach closure cost estimate and documentation on how the closure cost was calculated.

5.

Fencing:

☐ Four foot height, four strands of barbed wire evenly spaced between one and four feet

☒ Alternate. Please specify See attached variance request

6.

Signs:

☐ 12"x 24", 2" lettering, providing Operator's name, site location, and emergency telephone numbers

☒ Signed in compliance with 19.15.16.8 NMAC

7.

Variances:

Justifications and/or demonstrations that the proposed variance will afford reasonable protection against contamination of fresh water, human health, and the environment.

Check the below box only if a variance is requested:

☒ Variance(s): Requests must be submitted to the appropriate division district for consideration of approval. If a Variance is requested, include the variance information on a separate page and attach it to the C-147 as part of the application.

If a Variance is requested, it must be approved prior to implementation.

8.

Siting Criteria for Recycling Containment

Instructions: The applicant must provide attachments that demonstrate compliance for each siting criteria below as part of the application. Potential examples of the siting attachment source material are provided below under each criteria.

General siting

Ground water is less than 50 feet below the bottom of the Recycling Containment. NM Office of the State Engineer - iWATERS database search; USGS; Data obtained from nearby wells	☐ Yes ☒ No ☐ NA
Within incorporated municipal boundaries or within a defined municipal fresh water well field covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3, as amended. - Written confirmation or verification from the municipality; written approval obtained from the municipality	☐ Yes ☒ No ☐ NA
Within the area overlying a subsurface mine. - Written confirmation or verification or map from the NM EMNRD-Mining and Minerals Division	☐ Yes ☒ No
Within an unstable area. - Engineering measures incorporated into the design; NM Bureau of Geology & Mineral Resources; USGS; NM Geological Society; topographic map	☐ Yes ☒ No
Within a 100-year floodplain. FEMA map	☐ Yes ☒ No
Within 300 feet of a continuously flowing watercourse, or 200 feet of any other significant watercourse, or lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark). - Topographic map; visual inspection (certification) of the proposed site	☐ Yes ☒ No
Within 1000 feet from a permanent residence, school, hospital, institution, or church in existence at the time of initial application. - Visual inspection (certification) of the proposed site; aerial photo; satellite image	☐ Yes ☒ No
Within 500 horizontal feet of a spring or a fresh water well used for domestic or stock watering purposes, in existence at the time of initial application. - NM Office of the State Engineer - iWATERS database search; visual inspection (certification) of the proposed site	☐ Yes ☒ No
Within 500 feet of a wetland. - US Fish and Wildlife Wetland Identification map; topographic map; visual inspection (certification) of the proposed site	☐ Yes ☒ No

9.
Recycling Facility and/or Containment Checklist:
Instructions: Each of the following items must be attached to the application. Indicate, by a check mark in the box, that the documents are attached.

- [X] Design Plan - based upon the appropriate requirements.
- [X] Operating and Maintenance Plan - based upon the appropriate requirements.
- [X] Closure Plan - based upon the appropriate requirements.
- [X] Site Specific Groundwater Data -
- [X] Siting Criteria Compliance Demonstrations –
- [X] **Certify that notice of the C-147 (only) has been sent to the surface owner(s)**

10.
Operator Application Certification:
I hereby certify that the information and attachments submitted with this application are true, accurate and complete to the best of my knowledge and belief.

Name (Print): Andrea Felix Title: Regulatory Manager

Signature: Date: 10-16-2018

e-mail address: afelix@enduringresources.com Telephone: (505) 386-8205

11.
OCD Representative Signature: **Approval Date:**

Title: Environmental Spec **OCD Permit Number:** 3RF-29

- [ ] OCD Conditions
- [X] Additional OCD Conditions on Attachment Attached Email Sent 10/19/18

C-147 Registration Package

Prepared for

Enduring Resources IV, LLC
200 Energy Court
Farmington, NM 87401
(505) 386-8205

Developed by

EIS
Energy Inspection Services

479 Wolverine Drive
Bayfield, Colorado 81122
Phone: (970) 881-4080

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1. Introduction

Applicant	Enduring Resources IV, LLC
Project Name	WLU 2309-24N
Project Type	Recycling Containment Registration
Legal Location	SE/4 SW/4 & SW/4, Section 24, T23N, R9W
Lease Number(s)	NMNM-135216-A

In accordance with NMAC 19.15.34, Enduring Resources IV, LLC (Enduring) requests the registration of the proposed Recycling Containment through the approval of this C-147 registration package. The facility and containments will be used to treat and recycle produced water for re-use in Enduring Resources IV, LLC completion activities.

This package contains the C-147 form and associated documents for registration of the WLU 2309-24N Recycling Containment.

A copy of the C-147 has been submitted to the land owner, the Bureau of Land Management.

2. Variance Explanation

All requested variance provide equal or better protection of fresh water, public health, and the environment.

C-147 #5 Fencing

19.15.34.12.D(1) NMAC states "Recycling containments shall be fenced with a four foot fence that has at least four strands of barbed wire evenly spaced in the interval between one foot and four feet above ground level."

Enduring will install an eight (8) foot chain link fence with one strand of barbed wire around the facility as requested by the surface owners to allow for greater protection to the facility than the requirements of 19.15.34.12.D(1)

3. Siting Criteria

3.1. Distance to Groundwater

The NM State Engineers Office iWaters Database shows a water well within section 25 of township 23N and range 9W. The elevation of the iWaters Data Point SJ01710 is approximately 6827' with a groundwater depth of 173'. The WLU 2309-24N has an elevation of 6870' which is an increase of 43' establishing the estimated groundwater depth for the WLU 2309-24N to be greater than 200'. Therefore, the groundwater depth is greater than 50 feet below the bottom of the recycling containment.

3.2. Distance to Surface Water

There are not any continuously flowing watercourses within 300' nor any other significant watercourse and lakebed or playa lake within 200' of the recycling containment as shown on the Aerial or Topo maps provided.

3.3. Distance to Structures

There are no permanent residence, school, hospital, institution or church at the time of initial registration within 1000' of the recycling containment as shown on the Aerial and Topo maps provided.

3.4. Distance to Non-Public Water Supply

There are no springs or fresh water wells used for domestic or stock water purposes within 500' in existence at the time of initial registration as shown on the Aerial and Topo maps provided.

3.5. Distance to Municipal Boundaries and Defined Fresh Water Fields

The recycling facility is not within any incorporated municipal boundaries within a defined municipal fresh water well field covered by a municipal ordinance adopted pursuant to Section 3-27-3 NMSA 1978, as amended.

3.6. Distance to Subsurface Mines

The recycling containment is not located in an "unstable" area. The location is not over a mine and is not on the side of a hill. The location of the excavated surface material will not be located within 100 feet of a continuously flowing or significant watercourse. According to the NM EMNRD Mining and Mineral Divisions database there are no subsurface mines in Section 24, Township 23N, Range 9W of San Juan County.

3.7 Distance to 100-Year Floodplain

The WLU 2309-24N proposed recycling containment is not located within a 100-year floodplain as demonstrated on the FEMA Map.

4. Design and Construction Plan

In accordance with Rule 19.15.34 the following information describes the design and construction of the recycling containment on Enduring's locations.

The Enduring Design and Construction Plan assists Enduring personnel in ensuring compliance with the minimum design and construction requirements for recycling containments as defined by the NMOCD outlined in 19.15.34.12 NMAC. The plan applies to any Enduring Employee(s) and subcontractor(s) whose job requires them to assist with the design and construction of the recycling facility. The plan is designed to ensure compliance with the minimum design and construction requirements for recycling facilities as defined by the NMOCD outlined in 19.15.34.12 NMAC.

Enduring shall design and construct a recycling containment in accordance with the following specifications.

4.1. Foundation Construction

Approximately 6" of topsoil will be stripped and stockpiled for final cover at the time of closure. The topsoil will be stored on the perimeter of the permitted facility.

The recycling containment will have a properly constructed foundation and interior slopes consisting of a firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities to prevent the liner's rupture or tear. The containment will ensure confinement of produced water, to prevent releases and to prevent overtopping due to wave action or rainfall. A geotextile under the liner will be used, if needed, to reduce the localized stress-strain or protuberances that otherwise may compromise the liner's integrity. The final sub grade shall be scarified to a minimum depth of 12 inches, moisture conditioned to near Optimum Moisture and compacted to 95% of maximum dry density as determined by a Standard Proctor (ASTM 698).

Positive draining should be provided during construction and maintained throughout the life of the proposed project to prevent surface runoff from entering the pond. Protective slopes should be provided with a minimum grade of approximately 5 percent for at least 10 feet from the structures. Backfill against footings, exterior walls, and in utility trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration.

The pond inside Levey grade will be constructed no steeper than 2H:1V grade and the pond outside Levey grade will be constructed no steeper than 3H:1V grade.

4.2. Liner Construction

Enduring's recycling containment shall incorporate, a primary (upper) liner and a secondary (lower) liner with a leak detection system. The primary (upper) liner will be a 45-mil LLDPE string reinforced liner resistant to UV light, petroleum hydrocarbons, salt and acidic/alkaline solutions with a single sided texture to increase traction for emergency escape from the pit and shall cover the bottom and sides of the pit including the minimum three (3) feet of freeboard per NMOCD 19.15.17.11.G.9. Integrity of the primary liner shall be tested using the Dipole Method - Water Covered Geomembrane (ASTM D7007). The secondary liner will be a 45-mil LLDPE string reinforced liner with a single sided conductive coating for initial leak detection and shall cover the bottom and sides of the pit including the minimum three (3) feet of freeboard per NMOCD 19.15.17.11.G.9. Integrity of the secondary liner shall be tested using the Conductive-Backed Geomembrane Spark Testing Method (ASTM D7240).

A secondary leak detection system will be installed at the designated corner of each pit. The pit bottom will be sloped to the detection system that will be comprised of SDR-17 HDPE solid and perforated pipe with 1-1/2" Type F coarse drain rock bedding. Enduring will install manufacturer recommended Geoconduct 250 geocomposite with a conductive grid between non-woven needle-punched geotextiles produced by Afitex Texel. The product consists of two geotextile layers comprised of short synthetic fibers of 100% polypropylene or polyester which are needle punched together with a structural conductive grid. The conductive grid comprises two conductive inox

cables forming a 50 mm x 50 mm network. Geoconduct is compatible with geoelectrical leak location surveys.

Enduring shall ensure the subcontractor installing the recycling containment minimized liner seams and orient them up and down, not across, a slope of the levee. Enduring shall ensure that factory welded seams shall be used where possible. Enduring shall ensure the subcontractor installing the recycling containment ensures field seams in the geosynthetic material are thermally seamed and that prior to any field seaming, the installer overlaps the liners four to six inches. The subcontractor installing the liner shall minimize the number of field seams and corners and irregularly shaped areas. Enduring will only hire qualified personnel to perform field welding and testing.

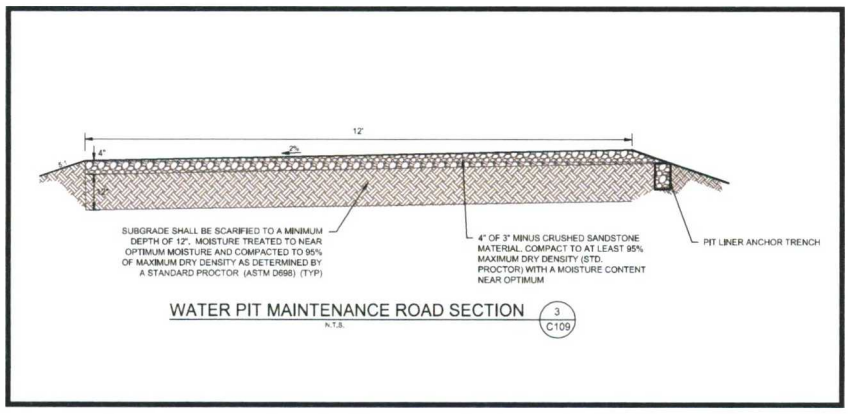
Enduring shall install manufacturer recommended DrainTube gas ventilation geocomposite grid produced by Afitex Texel. This layer is intended to vent in situ gases that have potential to create "whale" in the produced water pit that would decrease storage capacity. The product consists of a drainage layer and a filter layer comprised of short synthetic staple fibers of 100% polypropylene needle-punched together with perforated corrugated polypropylene pipes regularly spaced, up to 4 pipes per meter, inside. The pipes have two perforations per corrugation at 180 degrees and alternating at 90 degrees. https://www.draintube.net/docs/en/download/technical_data_sheet/draintube_300p_st_series_fos.pdf

The liner system shall be anchored as designed in a 2 FT x 2.5 FT anchor trench and topped with 6 inches of road base.

At the point of discharge into or suction from the recycling containment, Enduring will insure that the liner is protected from excessive hydrostatic force and potential mechanical damage. External discharge and/or suction lines will not penetrate the liner.

4.3. Leak Detection System

Enduring shall place a leak detection system between the upper and lower geomembrane liners that shall consist of a 200-mil genet to facilitate drainage. The leak detection system shall consist of a properly designed drainage and collection and removal system placed above the lower geomembrane liner in depressions and sloped to facilitate the earliest possible leak detection. A 3 foot wide by 3 foot long by 2 foot deep depression will be contracted to allow for collection of any leaking liquid. A 4 inch PVC liner will be installed in between the primary and secondary liners from the top of the tank to the depression to allow for detection and removal of liquid.



4.4. Signage

Enduring will sign the containment with an upright sign no less than 12″ by 24″ with lettering not less than 2″ in height in a conspicuous place near the containment. Enduring will provide the operator's name, location of the containment by quarter-quarter or unit letter, Section, Township, Range and emergency telephone numbers.

4.5. Entrance Protection

Enduring will surround the containment with an eight foot chain link fence. All gates leading in and out of the containment will be closed and locked when personnel are not on-site. The fencing will be kept in good repair, and shall be inspected as part of the weekly inspection performed at the containment facility.

4.6. Wildlife Protection

Enduring will install a bird deterrent system pursuant to the attached *Migratory Bird Mitigation Plan*. The containment will be inspected weekly for dead migratory birds and will be reported accordingly.

5. Maintenance and Operating Plan

In accordance with Rule 19.15.34 the following information describes the operation and maintenance of recycling containments on Enduring's locations.

5.1. Inspection Timing

Enduring shall inspect the recycling containment and associated leak detection systems weekly while it contains fluids. A current log of inspections will be maintained and the log will be made available for review upon division request. If fluids are found in the sump, a primary liner test utilizing the Dipole Method - Water Covered Geomembrane (ASTM D7007) will be conducted. In addition to human monitoring the pond fluid level will be determined via two (2) hydrostatic pressure gauges and a float gauge. At a fluid height of 22′, an automated valve will close and prevent any more fluid from entering the containment.

5.2. Maintenance

1. Enduring shall maintain and operate the recycling containment as follows:
   A. Removing any visible lay of oil from the surface of the containment.
   B. Maintaining at least 3′ of freeboard at each containment
   C. The injection or withdrawal of fluids from the containment shall be accomplished through a header, diverter or other hardware that prevents damage to the liner by erosion, fluid jets, or impact from installation and removal of hoses and pipes
   D. If the containment's primary liner is compromised above the fluid's surface, Enduring will repair the damage or initiate replacement of the primary liner within 48 hours of discovery or seek an extension from the division district office.

E. If the primary liner is compromised below the fluid's surface, Enduring will remove all fluid above the damage or leak within 48 hours of discovery, notify the divisions distraction office and repair the damage or replace the primary liner.
F. The containment will be operated to prevent the collection of surface water run-on with containment walls of 9.5' height.
G. Enduring will install, or maintain on site, an oil absorbent boom or other device to contain an unanticipated release.
H. Enduring will not store or discharge any hazardous waste at the facility or within the containment.

5.3. Cessation of Operations

Enduring will report the cessation of operations or if less than 20% of the total fluid capacity is used every six months following the first withdrawal of produced water for use to the appropriate division district office. If additional time is needed for closure, Enduring will request an extension from the appropriate division district office prior to the expiration of the initial six month time period.

6. Closure Plan

In accordance with Rule 19.15.34 the following information describes the closure requirements of recycling containments on Enduring's locations.

All closure activities will include proper documentation and be available for review upon request and will be submitted to the OCD within 60 days of closure. Closure report will be filed on C-147 and incorporate the following:

- Details on capping and covering, where applicable
- Inspection Reports
- Sampling Results

Once Enduring has ceased operations, all fluids will be removed within 60 days and the containment shall be closed within six months.

6.1 Fluid Removal

The containment will be closed by first removing all fluids, contents and synthetic liners and disposed of in a division-approved facility or recycle, reuse or reclaim the liquids in a manner that the appropriate division district office approves.

6.2 Soil Sampling

Enduring will test the soils beneath the containment for contamination with a five-point composite sample which includes stained or wet soils, if any, and that sample shall be analyzed for the constituents listed in Table I below:

Components	Test Method	51' - 100' GW Depth Limit (mg/kg)	>100' GW Depth Limit (mg/kg)
Chloride	EPA 300.0	10,000	20,000
TPH (GRO+DRO+MRO)	EPA SW-846 Method 8015M	2,500	2,500
GRO + DRO	EPA SW-846 Method 8015M	1,000	1,000
BTEX	EPA SW-846 Method 8021B or 8260B	50	50
Benzene	EPA SW-846 Method 8021B or 8260B	10	10

a. If any containment concentration is higher than the parameters listed in Table I, Enduring will receive approval before proceeding with closures as the division may required additional delineation upon review of the results.
b. If all contaminant concentrations are less than or equal to the parameters listed in Table I then Enduring will proceed to backfill with non-waste containing, uncontaminated, earthen material.

6.3 Reclamation

The topsoil and subsoil will be replaced to their original relative positions and contoured so as to achieve erosion control, long-term stability and preservation of surface water flow patterns.

Enduring will reclaim and reseed the recycling containment area pursuant to the requirements listed in 19.15.34.14. Once Enduring has closed the recycling containment, we will reclaim the containment's location to a safe and stable condition that blends with the surrounding undisturbed area and matches the existing grade. Topsoils and subsoils shall be replaced to their original relative positions and contoured so as to prevent ponding and erosion. The disturbed area shall then be reseeded in the first favorable growing season following closure of a recycling containment. Enduring will restore the impacted surface area to the condition that existed prior to the construction of the recycling containment.

Reclamation of all disturbed areas no longer in use shall be considered completed when all ground surface disturbing activities at the site have been completed, and a uniform vegetative cover has been established that reflects a life-form ratio of plug or minus fifty percent (50%) of pre-disturbance levels and a total percent plant cover of at least seventy percent (70%) of pre-disturbance levels, excluding noxious weeds.

The re-vegetation and reclamation obligations imposed by federal, state trust land or tribal agencies on lands managed by those agencies shall supersede these provisions and govern the obligations of any operator subject to those provisions, provided that the other requirements provide equal or better protection of fresh water, human health and the environment. Enduring will notify the OCD district office when reclamation and revegetation have been completed.

New Mexico Office of the State Engineer

Water Column/Average Depth to Water

(A CLW##### in the POD suffix indicates the POD has been replaced & no longer serves a water right file.)

(R=POD has been replaced, O=orphaned, C=the file is closed)

(quarters are 1=NW 2=NE 3=SW 4=SE)
(quarters are smallest to largest)

(NAD83 UTM in meters)

(In feet)

POD Number	Code	POD Sub-basin	County	Q 64	Q 16	Q 4	Sec	Tws	Rng	X	Y	DepthWell	DepthWater	Water Column
SJ 01710		SJ	SJ	1	3		25	23N	09W	252985	4009203*	550	173	377

Average Depth to Water: **173 feet**

Minimum Depth: **173 feet**

Maximum Depth: **173 feet**

Record Count: 1

PLSS Search:

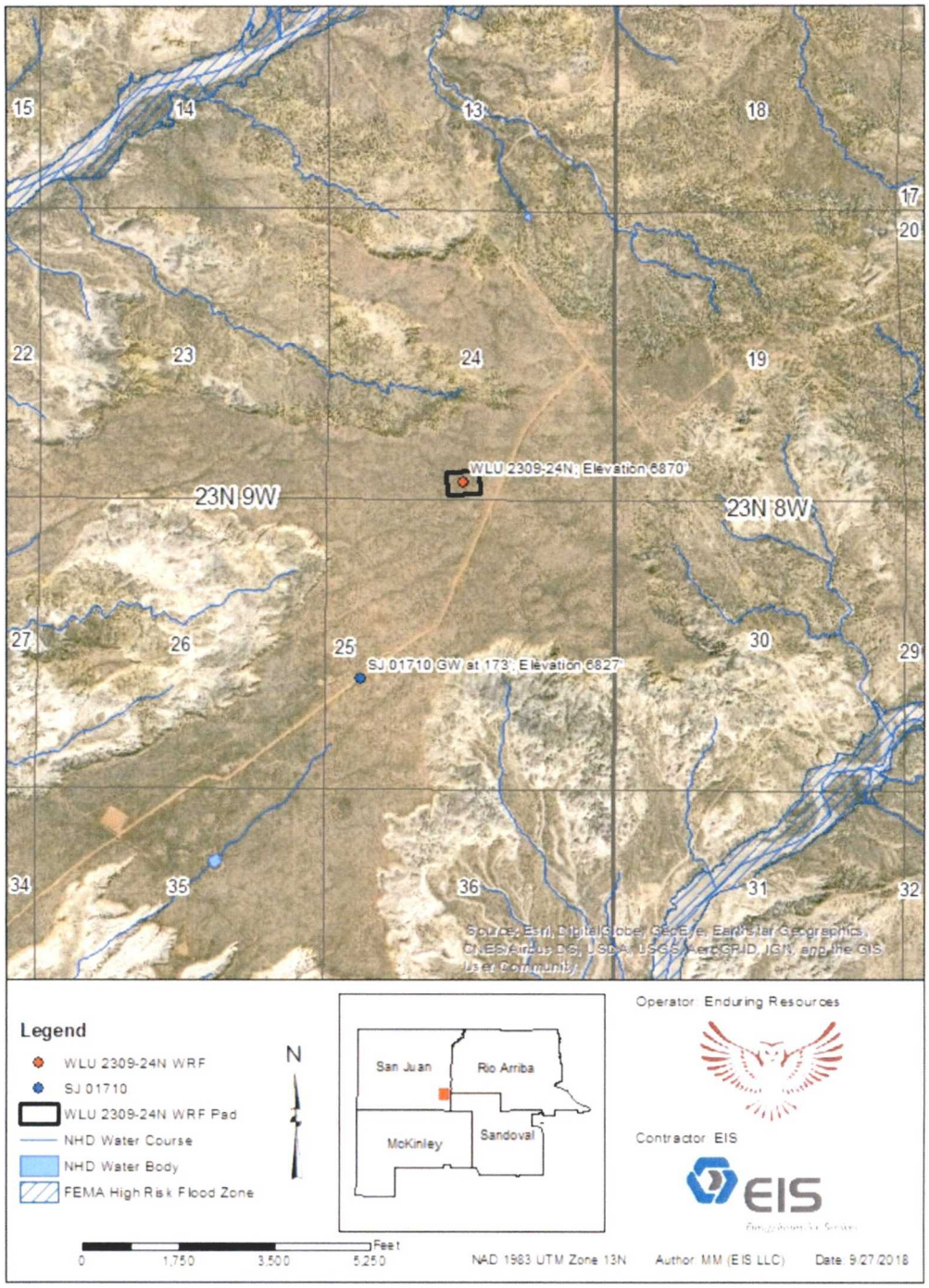
Section(s): 13, 14, 15, 22, 23, 24, 25, 26, 27 Township: 23N Range: 09W

***UTM location was derived from PLSS - see Help**

9/26/18 2:15 PM

WATER COLUMN/ AVERAGE DEPTH TO WATER

8. Aerial Map


15
14
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22
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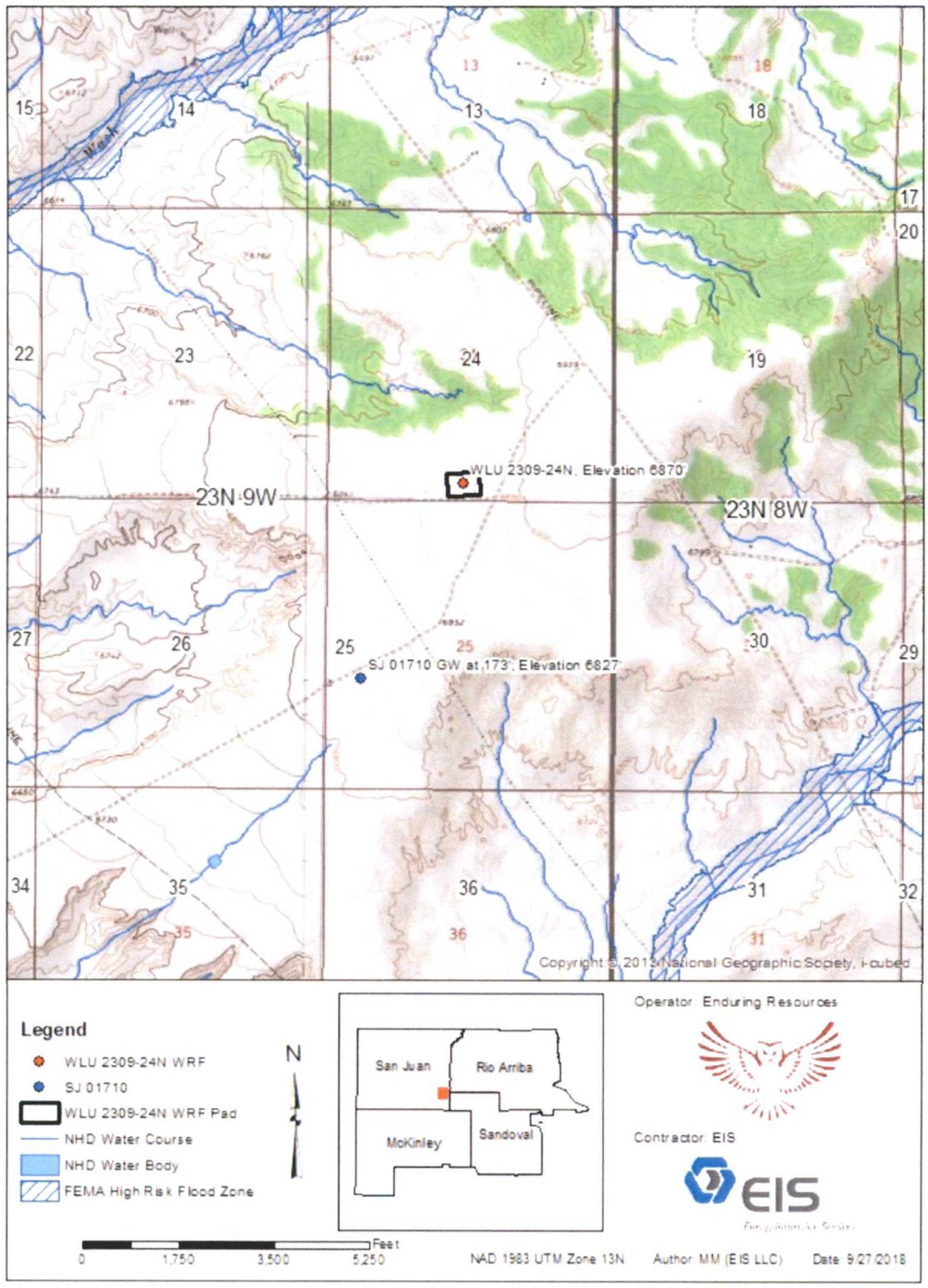
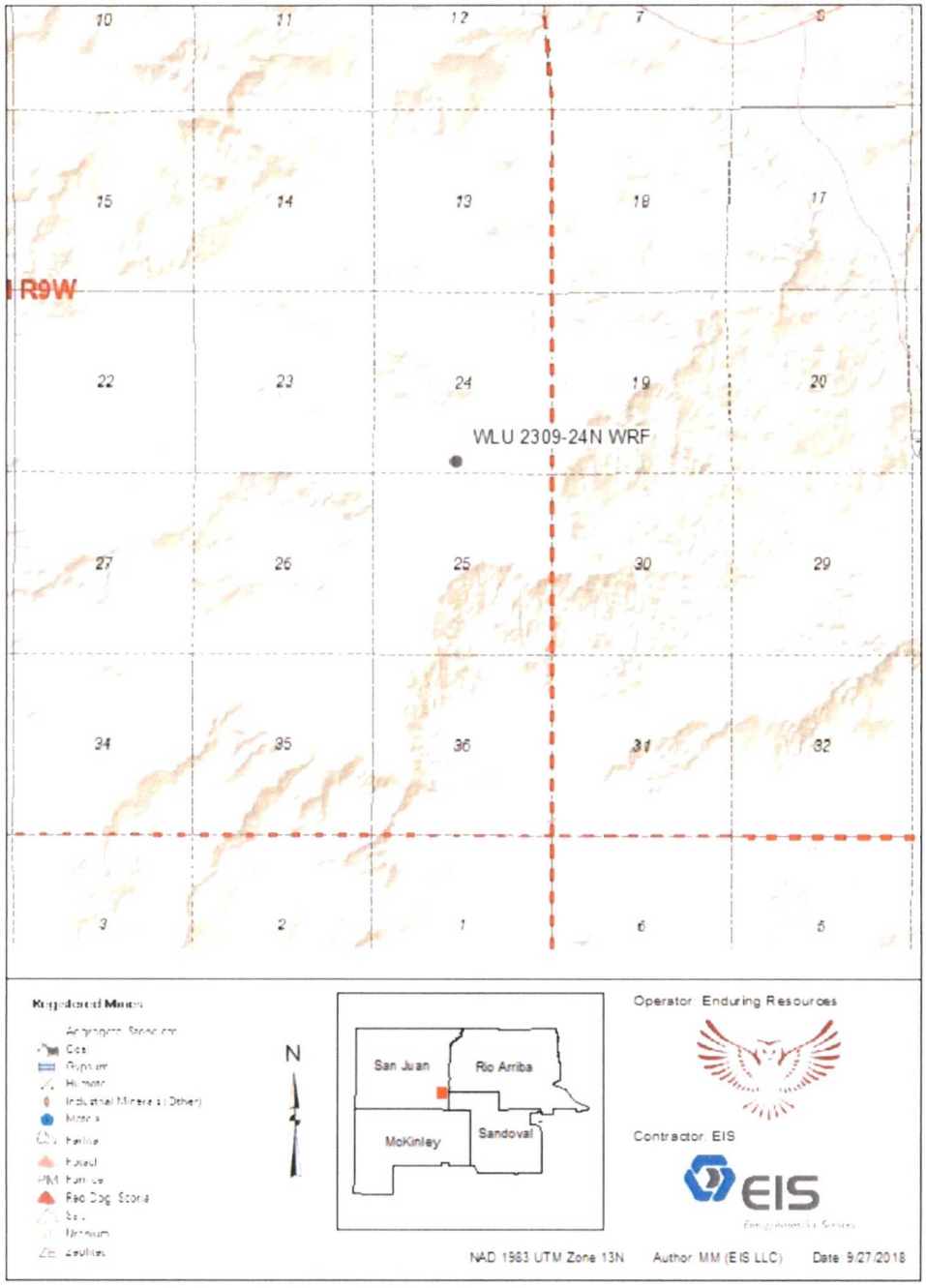
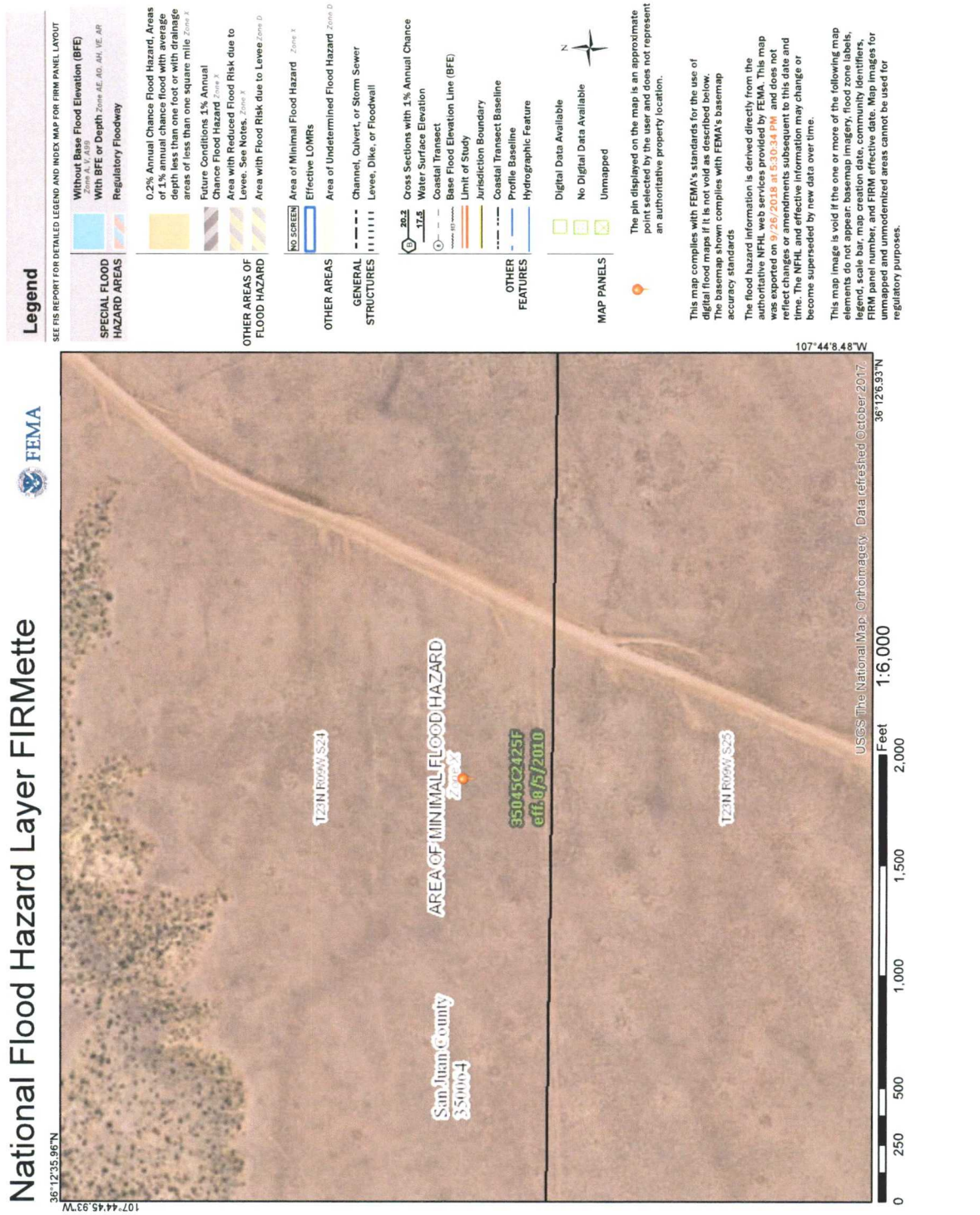
24
19
WLU 2309-24N, Elevation 6870'
23N 9W
23N 8W
27
26
25
SJ 01710 GW at 173', Elevation 6827'
30
29
34
35
36
31
32
Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Legend
WLU 2309-24N WRF
SJ 01710
WLU 2309-24N WRF Pad
NHD Water Course
NHD Water Body
FEMA High Risk Flood Zone
N
San Juan
Rio Arriba
McKinley
Sandoval
Operator Enduring Resources
Contractor EIS
EIS
0
1,750
3,500
5,250
Feet
NAD 1983 UTM Zone 13N
Author MM (EIS LLC)
Date 9/27/2018

9. Topo Map


WLU 2309-24N, Elevation 6870'
SJ 01710 GW at 173', Elevation 6827'
23N 9W
23N 8W
Copyright © 2013 National Geographic Society, i-cubed
Legend
WLU 2309-24N WRF
SJ 01710
WLU 2309-24N WRF Pad
NHD Water Course
NHD Water Body
FEMA High Risk Flood Zone
N
San Juan
Rio Arriba
McKinley
Sandoval
Operator: Enduring Resources
Contractor: EIS
Feet
0
1,750
3,500
5,250
NAD 1983 UTM Zone 13N
Author: MM (EIS LLC)
Date: 9/27/2018

10. Mines Mills Map




National Flood Hazard Layer FIRMette
FEMA
36°12'35.96"N
107°44'45.93"W
107°44'8.48"W
36°12'6.93"N
San Juan County
350004
AREA OF MINIMAL FLOOD HAZARD
Zone X
35045C2425F
eff. 8/5/2010
T23N R09W S24
T23N R09W S25
0 250 500 1,000 1,500 2,000 Feet
1:6,000
USGS The National Map: Orthoimagery. Data refreshed October 2017.
Legend
SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT
SPECIAL FLOOD HAZARD AREAS
Without Base Flood Elevation (BFE) Zone A, V, A99
With BFE or Depth Zone AE, AO, AH, VE, AR
Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD
0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
Future Conditions 1% Annual Chance Flood Hazard Zone X
Area with Reduced Flood Risk due to Levee. See Notes. Zone X
Area with Flood Risk due to Levee Zone D
OTHER AREAS
NO SCREEN Area of Minimal Flood Hazard Zone X
Effective LOMRs
Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES
Channel, Culvert, or Storm Sewer
Levee, Dike, or Floodwall
OTHER FEATURES
20.2 Cross Sections with 1% Annual Chance
17.5 Water Surface Elevation
Coastal Transect
Base Flood Elevation Line (BFE)
Limit of Study
Jurisdiction Boundary
Coastal Transect Baseline
Profile Baseline
Hydrographic Feature
MAP PANELS
Digital Data Available
No Digital Data Available
Unmapped
N
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/26/2018 at 5:30:34 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

12. HYDROLOGY REPORT

Hydrogeological Report for WLU 2309-24N Water Recycle Facility

Regional Geological context:

The Nacimiento Formation is of Paleocene age (Baltz, 1967, p. 35). It crops out in a broad band inside the southern and western margins of the central basin and in a narrow band along the west face of the Nacimiento Uplift. The Nacimiento is a nonresistant unit and typically erodes to low, rounded hills or forms badland topography.

The Nacimiento Formation occurs in approximately only the southern two-thirds of the San Juan Basin where it conformably overlies and intertongues with the Ojo Alamo Sandstone (Fassett, 1974, p. 229). The Nacimiento Formation grades laterally into the main part of the Animas Formation (Fassett and Hinds, 1971, p. 34); thus, in this area, the two formations occupy the same stratigraphic interval.

Strata of the Nacimiento Formation were deposited in lakebeds in the central basin area with lesser deposition in stream channels (Brimhall, 1973, p. 201). In general, the Nacimiento consists of drab, interbedded black and gray shale with discontinuous, white, medium- to very coarse grained arkosic sandstone (Stone e al., 1983, p.30). Stone et al. indicated that the formation may contain more sandstone than commonly reported because some investigators assume the slope-forming strata in the unit area shales, whereas in many places the strata actually are poorly consolidated sandstones. Total thickness of the Nacimiento Formation ranges from about 500 to 1,300 feet. The unit generally thickens from the basin margins toward the basin center (Steven et al., 1974). The sandstone deposits within the Nacimiento Formation are much thinner than the total thickness of the formation because their environment of deposition was localized stream channels (Brimhall, 1973, p. 201). The thickness of the combined San Jose, Animas, and Nacimiento Formations ranges from 500 to more than 3.500 feet.

Hydraulic Properties:

Reported well yields for 53 wells completed in either the Animas or Nacimiento Formations range from 2 to 90 gallons per minute and the median yield is *7.5* gallons per minute. The primary use of water from Nacimiento and Animas Formations is domestic and livestock supplies. There are no known aquifer tests for the Animas or Nacimiento Formations, but specific capacities reported for six wells range from 0.24 to 2.30 gallons per minute per foot of drawdown (Levings et al., 1990).

The Animas and Nacimiento Formations are in many ways hydrologically similar to the San Jose Formation because sands in both units produce approximately the same quantities of water. However, the greater percentage of fine materials in the Animas and Nacimiento Formations may restrict downward vertical leakage to the Ojo Alamo Sandstone or Kirtland Shale. The poorly cemented fine material is highly erodible, forms a badland terrain, and supports only spotty vegetation. These conditions are more conductive to runoff than retention of precipitation.

References:

Baltz, E.H., 1967, Stratigraphy and regional tectonic implications of part of Upper Cretaceous rocks, east-central San Juan Basin, New Mexico: USGS Professional Paper 552, 101 p.
Brimhall, R.M., 1973, Ground-water hydrology of Tertiary rocks of the San Juan Basin, New Mexico, in Fassett, J.E., ed., Cretaceous and Tertiary rocks of the Southern Colorado Plateau: Four Corners Geological Society Memoir, p. 197-207.
Fassett, J.E., 1974, Cretaceous and Tertiary rocks of the eastern San Juan Basin, New Mexico and Colorado, in Guidebook of Ghost Ranch, central-northern New Mexico: New Mexico Geological Society, 25th Field Conference, p. 225-230.
Fassett, J.E., and Hinds, J.S., 1971, Geology and fuel resources of the Fruitland Formation and Kirtland Shale of the San Juan Basin, New Mexico and Colorado: USGS Professional Paper 676, 76 p.
Levings, G.W., Craigg, S.d., Dam, W.L., Kernodle, J.M., and Thorn, C.R., 1990, Hydrogeology of the San Jose, Nacimiento, and Animas Formations in the San Juan structural basin, New Mexico, Colorado, Arizona, and Utah: USGS Hydrologic Investigations Atlas HA-720-A, 2 sheets.
Stone, W.J., Lyford, F.P., Frenzel, P.F., Mizell, N.H., and Padgett, E.T., 1983, Hydrogeology and water resources of San Juan Basin, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Hydrologic Report 6.

13. Surface Owner Notification

RECEIVED

JUL 02 2018

Farmington Field Office
Bureau of Land Management

Form 3160-5
(June 2015)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

FORM APPROVED
OMB No. 1004-0137
Expires: January 31, 2018

SUNDRY NOTICES AND REPORTS ON WELLS

Do not use this form for proposals to drill or to re-enter an abandoned well. Use Form 3160-3 (APD) for such proposals.

SUBMIT IN TRIPLICATE - *Other instructions on page 2*

5. Lease Serial No.

6. If Indian, Allottee or Tribe Name

7. If Unit of CA/Agreement, Name and/or No.
NMNM 135216A

1. Type of Well
☒ Oil Well ☐ Gas Well ☐ Other

8. Well Name and No.
W Lybrook Unit

2. Name of Operator
Enduring Resources, LLC

9. API Well No.

3a. Address
332 Cr 3100 Aztec, NM 87410

3b. Phone No. *(include area code)*
505-636-9741

10. Field and Pool or Exploratory Area
Lybrook Mancos W

4. Location of Well *(Footage, Sec., T., R., M., or Survey Description)*

11. Country or Parish, State
San Juan, NM

12. CHECK THE APPROPRIATE BOX(ES) TO INDICATE NATURE OF NOTICE, REPORT OR OTHER DATA

TYPE OF SUBMISSION	TYPE OF ACTION			
☒ Notice of Intent	☐ Acidize	☐ Deepen	☐ Production (Start/Resume)	☐ Water ShutOff
	☐ Alter Casing	☐ Hydraulic Fracturing	☐ Reclamation	☐ Well Integrity
☐ Subsequent Report	☐ Casing Repair	☐ New Construction	☐ Recomplete	☐ Other W LYBROOK STAGING AREA
☐ Final Abandonment Notice	Change Plans	☐ Plug and Abandon	☐ Temporarily Abandon	
	☐ Convert to Injection	☐ Plug Back	☐ Water Disposal	

13. Describe Proposed or Completed Operation: Clearly state all pertinent details, including estimated starting date of any proposed work and approximate duration thereof. If the proposal is to deepen directionally or recomplete horizontally, give subsurface locations and measured and true vertical depths of all pertinent markers and zones. Attach the Bond under which the work will be performed or provide the Bond No. on file with BLM/BIA. Required subsequent reports must be filed within 30 days following completion of the involved operations. If the operation results in a multiple completion or recompletion in a new interval, a Form 3160-4 must be filed once testing has been completed. Final Abandonment Notices must be filed only after all requirements, including reclamation, have been completed and the operator has determined that the site is ready for final inspection.)

W LYBROOK UNIT-

Enduring Resources IV, LLC is changing the well completion operation from a nitrogen to a slick water completion operation. This change in completion operations will allow for the use and reuse of nonpotable water and will significantly reduce the amount of flaring needed to clean a well up to pipeline quality.

Enduring would like to utilize the approved West Lybrook Unit staging area as a Water Recycling Facility in order to achieve the goal of a slick water completion operation.

The facility will consist of a water supply well sourcing nonpotable water from the Entrada formation for oil and gas completion and recycling purposes which will be permitted with the Office of the State Engineer. This facility will supply water for Enduring Resources IV, LLC operations only and within the approved West Lybrook, Rodeo and Kimbeto units. Surface water lines will be utilized within the already approved pipeline ROW corridors to transfer the water to each location for completion activities. No new surface approvals are necessary for this request, Enduring will follow all existing stipulations and COA's.

A C102 of the approved West Lybrook staging area is attached.

APPROVAL OF THIS ACTION DOES NOT RELIEVE THE OPERATOR FROM OBTAINING ANY OTHER AUTHORIZATION REQUIRED FOR OPERATIONS ON FEDERAL AND INDIAN LANDS

14. I hereby certify that the foregoing is true and correct. Name *(Printed/Typed)*
Andrea Felix

Title Regulatory Manager

Signature

Date 7/2/18

THE SPACE FOR FEDERAL OR STATE OFICE USE

Approved by

Title PE

Date 7/9/18

Conditions of approval, if any, are attached. Approval of this notice does not warrant or certify that the applicant holds legal or equitable title to those rights in the subject lease which would entitle the applicant to conduct operations thereon.

Office PFO

Title 18 U.S.C. Section 1001 and Title 43 U.S.C. Section 1212, make it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

OPERATOR

Enduring Resources, LLC's
Recycling Containment
Migratory Bird Mitigation Plan

Enduring Resources, LLC (Enduring) is proposing this Migratory Bird Mitigation Plan (Mitigation Plan) in compliance with the New Mexico Oil Conservation Division (NMOCD) Rule 19.15.34.12.E Enduring shall ensure that the recycling containment is protective of wildlife by implementing the following proposed Mitigation Plan. Enduring employees will inspect the containment weekly for and, within 30 days of discovery, report the discovery of dead migratory birds or other wildlife to the appropriate wildlife agency and to the division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring. This Mitigation Plan will utilize a combination of visual and audio deterrents to discourage wildlife, particularly birds and bats, from the recycling containment in order to mitigate potential impacts. This Mitigation Plan would be implemented while the Recycling Containment is active and in use, as to not desensitize birds to the deterrents.

The following mitigations will be implemented to reduce any wildlife impacts that may occur from the Recycling Containment:

- The following visual bird deterrents will be installed (Appendix A):
    - Bird-X Prowler Owl decoys will be installed at all four corners of the Containment.
    - Scare-Eye Balloons will be installed along the perimeter of the Containment.
- A Bird-X BroadBand PRO System will be installed at the Containment facility. It utilizes sonic (naturally-recorded bird destress calls & predator cries) to deter birds; as well as, ultrasonic high-frequency sound waves to deter bats. Bird propane cannons were avoided, so as not to disturb other wildlife species.
- The containment will be inspected on a monthly basis when water is present in the containment. All inspectors will insure the containment is receiving only filtered produced water with no hydrocarbons, as well as being trained to inspect the premises for, and respond to any wildlife incident, should it occur.
- Inspection will include:
    - An inspection of the filtration system and all visual and audio deterrents to insure they are in working order and functioning properly.
    - A thorough search of the entire containment facility, and just beyond, for the presence of any wildlife (entrapped, injured, dead, etc.).
- In the event a wildlife incident should occur, James McDaniel with Enduring will be contacted immediately and he will notify the appropriate wildlife agency and division district office. Enduring, appropriate wildlife agency, and division district office will then work collaboratively to address the incident appropriately to insure the incident does not reoccur.

BIRD-X

Pest control for today's environment

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- Shock Track Systems
- Bird Balls
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- Visual Scares and Predator Decoys
- Bird Gels, Taste Aversions & OvoControl® P
- For Songbird Lovers
- Remote Control Drone
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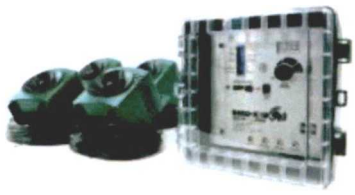
BroadBand PRO



- Combines SONIC and ULTRASONIC Bird Control Technology
- Creates Uninviting Environment For Birds
- Covers Up To SIX ACRES

IN STOCK - AVAILABLE IMMEDIATELY!

Deter Birds With Multi-Faceted Sonic and Ultrasonic Attack! The BroadBand PRO's 4-speaker system simultaneously emits sounds that are both audible and inaudible to humans that confuse, disorient, and intimidate pest birds, keeping them away.

Starting at ~~$850.00~~ **NOW $725.00 (15% SAVINGS!)**

Voltage Options: BroadBand PRO 110v ($725

Quantity: 1

Price: $725.00

Product Total: $725.00

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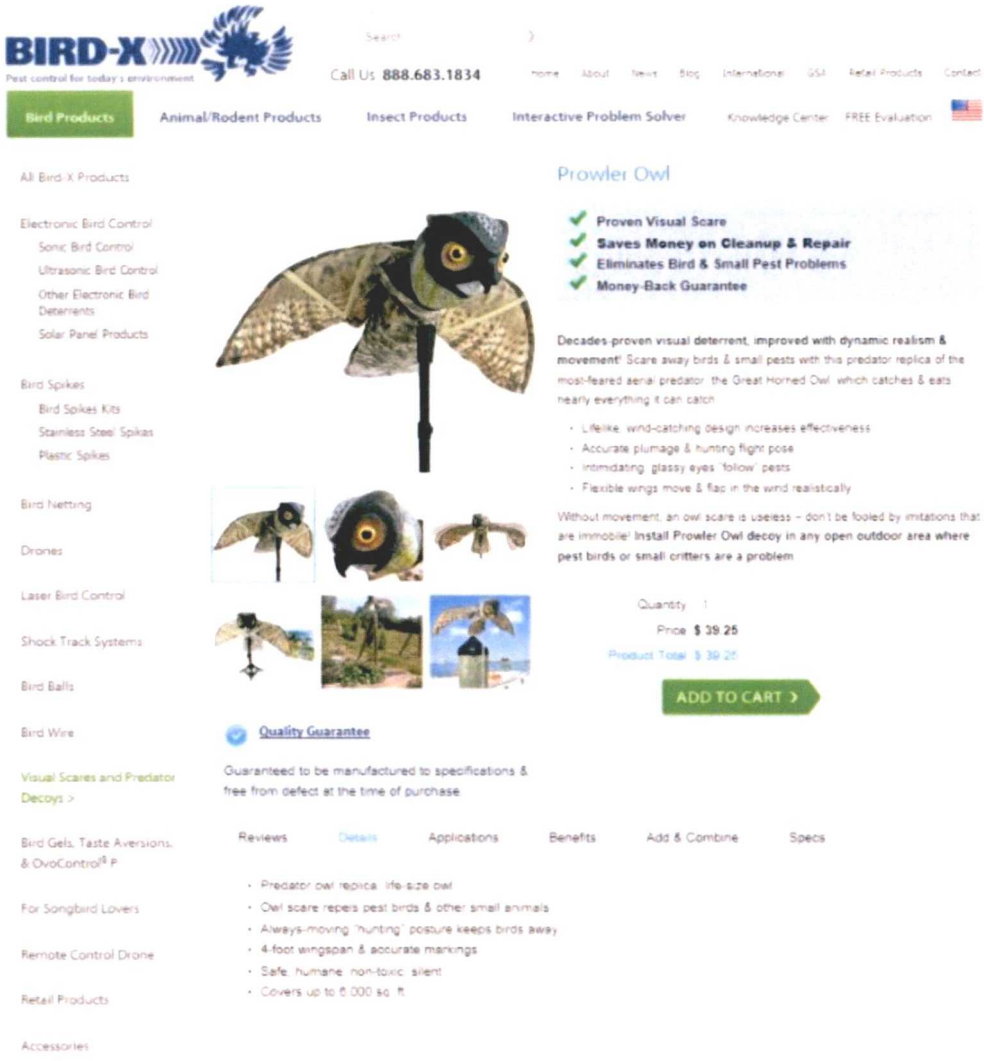
Guarantee + Warranty

Backed by our 30 Day Electronics Performance Satisfaction Guarantee AND our 6-Month Manufacturer's Warranty Against Material Defects

- **Option to add 3 Visual Scares to package for added efficacy**
- Emits a combination of audible noises & high-frequency sound waves that are silent-to-most-humans
  - **SONIC**: Uses naturally-recorded bird distress calls & predator ones; covers up to 6 acres
  - **ULTRASONIC**: Uses high-frequency sound waves; covers up to 3,600 sq. ft.
- 4 speakers included – 4 independent speakers with 100 ft. of wire each
- Fully programmable – control volume, sound delays, & daylight / night operation
- Weather resistant – NEMA type box is designed to withstand outdoor use
- Option to add an assortment of three (3) high-quality visual scare products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Proven Visual Scare
Saves Money on Cleanup & Repair
Eliminates Bird & Small Pest Problems
Money-Back Guarantee
Decades-proven visual deterrent, improved with dynamic realism & movement! Scare away birds & small pests with this predator replica of the most-feared aerial predator: the Great Horned Owl, which catches & eats nearly everything it can catch.
Lifelike, wind-catching design increases effectiveness
Accurate plumage & hunting flight pose
Intimidating, glassy eyes 'follow' pests
Flexible wings move & flap in the wind realistically
Without movement, an owl scare is useless – don't be fooled by imitations that are immobile! Install Prowler Owl decoy in any open outdoor area where pest birds or small critters are a problem.
Quantity 1
Price $ 39.25
Product Total: $ 39.25
ADD TO CART
Quality Guarantee
Guaranteed to be manufactured to specifications & free from defect at the time of purchase.
Reviews
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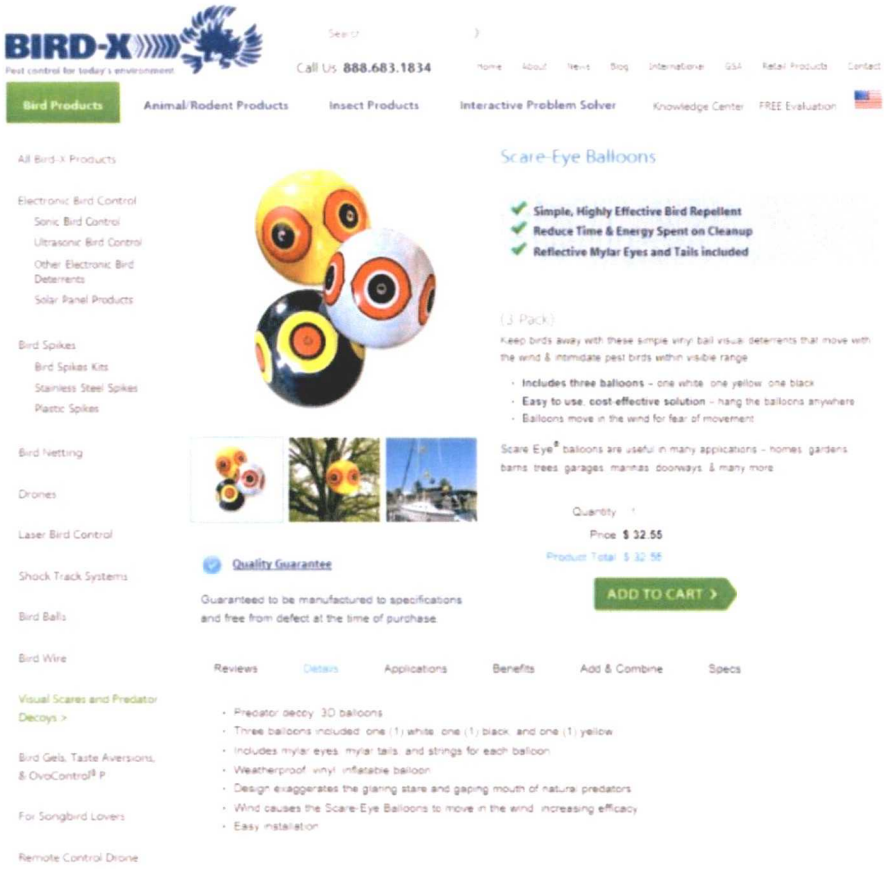
Benefits
Add & Combine
Specs
Predator owl replica, life-size owl
Owl scare repels pest birds & other small animals
Always-moving "hunting" posture keeps birds away
4-foot wingspan & accurate markings
Safe, humane, non-toxic, silent
Covers up to 6,000 sq. ft.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For Songbird Lovers
Remote Control Drone
Scare-Eye Balloons
Simple, Highly Effective Bird Repellent
Reduce Time & Energy Spent on Cleanup
Reflective Mylar Eyes and Tails included
(3 Pack)
Keep birds away with these simple vinyl bail visual deterrents that move with the wind & intimidate pest birds within visible range
Includes three balloons – one white, one yellow, one black
Easy to use, cost-effective solution – hang the balloons anywhere
Balloons move in the wind for fear of movement
Scare Eye® balloons are useful in many applications – homes, gardens, barns, trees, garages, marinas, doorways, & many more
Quantity 1
Price $ 32.55
Product Total $ 32.55
ADD TO CART >
Quality Guarantee
Guaranteed to be manufactured to specifications and free from defect at the time of purchase.
Reviews
Details
Applications
Benefits
Add & Combine
Specs
Predator decoy 3D balloons
Three balloons included: one (1) white, one (1) black, and one (1) yellow
Includes mylar eyes, mylar tails, and strings for each balloon
Weatherproof vinyl inflatable balloon
Design exaggerates the glaring stare and gaping mouth of natural predators
Wind causes the Scare-Eye Balloons to move in the wind, increasing efficacy
Easy installation

ATTACHMENT B - CONTAINMENT CONSTRUCTION PLANS

ENDURING RESOURCES
24N RECYCLING CONTAINMENT PIT PROJECT
CONSTRUCTION PLANS

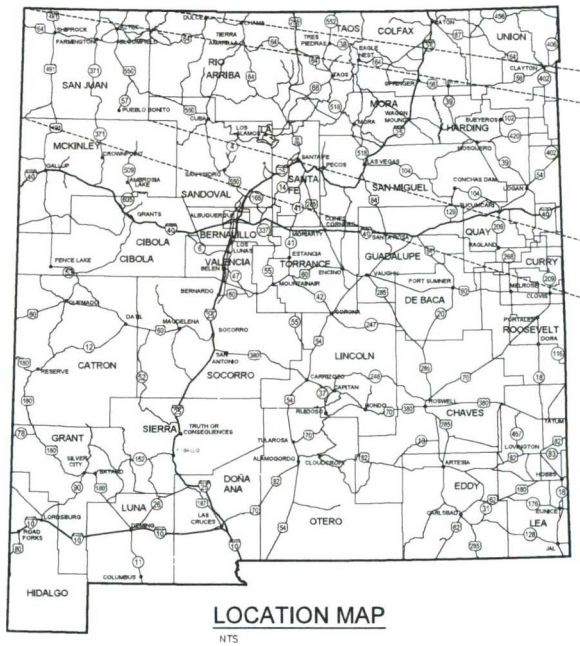
SITE CONTROL

CENTER OF PRODUCED WATER PIT Lat 36°12'21"N Long 107°44'26"W

SECTION 24, TOWNSHIP 23 NORTH, RANGE 9 WEST, NEW MEXICO PRINCIPAL MERIDIAN,
SAN JUAN COUNTY, NEW MEXICO

SAN JUAN COUNTY, NEW MEXICO
September 2018

PROJECT DESCRIPTION:
WEST LYBROOK RECYCLING PIT



LOCATION MAP
NTS

PROJECT LOCATION
NTS

VICINITY MAP
NTS

Sheet List Table

Sheet Number	Sheet Title
G100	COVER
G101	GENERAL NOTES AND LEGEND
C101	SITE MAP
C102	SITE GRADING AND DRAINAGE PLAN
C103	SITE PROFILE
C104	SITE CROSS-SECTIONS
C105	SITE HORIZONTAL CONTROL PLAN
C106	LINER BALLAST TUBES AND PIT GEOCOMPOSITE VENTILATION GRID LAYOUT
C107	GEOCOMPOSITE DETAILS
C108	LINER AND BALLAST TUBE DETAILS
C109	LEAK DETECTION SYSTEM AND PIT MAINTENANCE ROAD DETAILS
C110	CHAIN LINK SECURITY FENCE DETAILS
C111	SITE EROSION AND SEDIMENT CONTROL PLAN
C112	SITE EROSION AND SEDIMENTATION CONTROL DETAILS

THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION ON BEHALF OF SOUDER, MILLER & ASSOCIATES.

Heather D McDaniel September 28, 2018

HEATHER D. MCDANIEL, P.E. NM #22047 DATE
PROJECT MANAGER

Rev #	Date	Description	By	Chk'd

SOUDER, MILLER & ASSOCIATES
8000 W. 14th Avenue
Lakewood, CO 80214
Phone (303) 239-9011 Fax (303) 239-0745
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GENERAL NOTES:

1. SIGNED AND SEALED CONSTRUCTION DRAWINGS ARE PREPARED BASED ON EXISTING SITE CONDITIONS AND REGULATIONS PER THE SEALED DATE ON THE PLANS. DUE TO POSSIBLE CHANGES TO THE SITE, CODES, REGULATIONS, UNDERGROUND UTILITIES, ETC. BETWEEN THE SEALED DATE ON THE PLANS AND DATE OF CONSTRUCTION COMMENCEMENT, THE DESIGN AND RECOMMENDATIONS PROVIDED ARE LIMITED TO THE SEALED DATE ON THE PLANS. IF CHANGES TO ANY SITE CONDITIONS AND/OR REGULATIONS OCCUR BEFORE THE PROJECT CONSTRUCTION DATE, THE OWNER SHALL NOTIFY ENGINEER OF SUCH CHANGES AND OBTAIN THE ENGINEER'S OPINION AS TO THE COMPLETENESS OF THE PLANS AND SPECIFICATIONS. ANY SUCH CHANGE IN FIELD CONDITIONS AND/OR REGULATIONS MAY REQUIRE ADDITIONAL DESIGN SERVICES AND COMMENSURATE FEE INCREASE TO ACCOMMODATE SUCH CHANGES.

2. CLARIFICATIONS AND/OR REQUESTS REGARDING PROJECT INTENT AND MODIFICATIONS SHALL BE SUBMITTED TO THE ENGINEER PRIOR OR DURING CONSTRUCTION IN A FORMAL WRITTEN REQUEST FOR INFORMATION (RFI), THE ENGINEER SHALL NOT BE HELD LIABLE IF RECOMMENDATION(S) ARE ALTERED BY OTHERS.

3. SITE CONDITIONS, EACH SUBCONTRACTOR DOING WORK ON THE PROJECT SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR THE SAFETY OF ALL PERSONS AND PROPERTY WITHIN THEIR WORK AREAS, DAY AND NIGHT, DURING BOTH WORKING AND NONWORKING HOURS; AND, SHALL PROVIDE ALL BARRICADES, SHORING, FLAG MEN, SIGNS, LIGHTING AND OTHER DEVICES REQUIRED THEREOF.

4. THE CONTRACTOR WILL BE RESPONSIBLE FOR THE REPAIR AND/OR REPLACEMENT OF ANY DAMAGE DETERMINED TO BE CAUSED BY THE CONSTRUCTION OF THIS PROJECT TO ROADS, FENCES, DRAINAGE'S, DRAINAGE STRUCTURES, UTILITIES, INCLUDING CONDUIT, WIRING, EQUIPMENT, AND FIBER-OPTICS. THE CONTRACTOR SHALL REPAIR AND/OR REPLACE ALL DESTROYED OR DAMAGED SURFACE IMPROVEMENTS WITH IMPROVEMENTS EQUAL TO THOSE REMOVED.

5. STOCKPILING OF TOP SOIL: CONTRACTOR SHALL SEGREGATE AND STOCKPILE ALL TOPSOIL OUTSIDE OF THE CONSTRUCTION AREA WITH APPROPRIATE SEDIMENT CONTROL. TOP SOIL SHALL BE REDISTRIBUTED ON THE OUTSIDE OF CONSTRUCTED BERMS, AND EITHER SEEDED, AND MULCHED OR PROTECTED WITH EROSION CONTROL MEASURES, REFER TO CONSTRUCTION PLANS FOR DETAILS.

6. ALL EXISTING TRAFFIC SIGNS, MILEPOST MARKERS AND DELINEATORS WITHIN CONSTRUCTION LIMITS SHALL BE REMOVED OR OFFSET BY THE CONTRACTOR AS DIRECTED BY THE OWNER'S DESIGNEE. INFORMATION SIGNS ARE TO BE OFFSET, AND ALL OTHERS ARE TO BE REMOVED. THIS WORK WILL BE INCLUDED IN THE UNIT BID PRICE FOR REMOVAL OF STRUCTURES AND OBSTRUCTIONS.

7. THE CONTRACTOR SHALL MAINTAIN REASONABLE ACCESS TO ALL ADJACENT PROPERTIES BY PROVIDING EASY RIDING CONNECTIONS TO TURNOUTS AND DRIVEWAYS AS DETERMINED ACCEPTABLE BY THE OWNER'S REPRESENTATIVE OR DESIGNEE. THIS WORK WILL BE CONSIDERED INCIDENTAL TO COMPLETION OF THE PROJECT AND NO MEASUREMENT OF PAYMENT WILL BE MADE THEREFORE.

8. THE CONTRACTOR IS HEREBY ADVISED THAT UTILITY RELOCATION BY UTILITY COMPANIES WILL BE DONE CONCURRENTLY WITH CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE FOR UTILITY WORK IN CONJUNCTION WITH CONSTRUCTION OPERATIONS AND SHALL COORDINATE THE SCHEDULING OF WORK WITH THE RESPECTIVE UTILITY COMPANIES IN ORDER TO AVOID DELAYS DUE TO UTILITY WORK. THE CONTRACTOR SHALL PROVIDE FOR THESE CONTINGENCIES WHEN BIDDING THE PROJECT. NO CLAIM FOR DELAYS DUE TO UTILITY WORK WILL BE ALLOWED.

9. THERE IS NO CONSTRUCTION CLEAR ZONE FOR THIS PROJECT. THE CONTRACTOR SHALL NOT STORE EQUIPMENT OR MATERIAL OUTSIDE OF THE PROJECT BOUNDARIES ON THIS PROJECT. THIS WORK SHALL BE CONSIDERED INCIDENTAL TO THE COMPLETION OF THE PROJECT AND NO SEPARATE MEASUREMENT OR PAYMENT WILL BE MADE THEREFORE. CONTRACTOR TO COORDINATE WITH OWNER ON SITE STORAGE.

10. EMERGENCY ACCESS SHALL REMAIN OPEN AT ALL TIMES.

11. THE CONTRACTOR WILL REMOVE AND PROTECT ROAD NAME SIGNS DURING CONSTRUCTION AND REPLACE AS SOON AS POSSIBLE AFTER CONSTRUCTION.

12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPORTING AND CLEAN UP OF SPILLS ASSOCIATED WITH PROJECT CONSTRUCTION AND SHALL REPORT AND RESPOND TO SPILLS OF HAZARDOUS MATERIAL SUCH AS GASOLINE, DIESEL, MOTOR OILS, SOLVENTS, CHEMICALS, TOXIC AND CORROSIVE SUBSTANCES, AND OTHER MATERIALS WHICH MAY BE A THREAT TO PUBLIC HEALTH OR THE ENVIRONMENT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPORTING PAST SPILLS ENCOUNTERED DURING CONSTRUCTION AND OF CURRENT SPILLS NOT ASSOCIATED WITH CONSTRUCTION. REPORTS SHALL BE MADE IMMEDIATELY TO THE ENVIRONMENTAL EMERGENCY SPILL REPORTING LINE AT 1-866-428-6535 AND TO THE OWNER'S REPRESENTATIVE OR DESIGNEE. ANY UNREPORTED SPILLS IDENTIFIED AFTER CONSTRUCTION AND ASSOCIATED WITH PROJECT CONSTRUCTION SHALL BE CLEANED UP BY THE CONTRACTOR IN ACCORDANCE WITH THE CONTRACT. THE CONTRACTOR SHALL BEAR THE FULL COST OF CLEANUP OF SUCH UNREPORTED SPILLS.

13. FINAL PAYMENT OF CONCRETE AND REINFORCING BARS SHALL BE BASED ON PLAN QUANTITIES. IF THE DESIGN IS REVISED DURING CONSTRUCTION OR IF A QUANTITY CHANGE IS REQUIRED DUE TO ERRORS ON THE PLANS, THE PAYMENT SHALL BE BASED ON COMPUTED FIELD QUANTITIES MEASURED TO NEAT LINES.

14. EXISTING FENCE, SIGNS AND OTHER ITEMS OF PRIVATE PROPERTY FOUND TO BE WITHIN THE RIGHT-OF-WAY ARE TO BE REMOVED AND REPLACED AT THE EDGE OF RIGHT-OF-WAY, BY THE CONTRACTOR. THIS WORK WILL BE CONSIDERED INCIDENTAL TO THE COMPLETION OF THE PROJECT AND NO MEASUREMENT OF PAYMENT WILL BE MADE THEREFORE.

15. THROUGHOUT THE LIFE OF THE PROJECT THE CONTRACTOR SHALL KEEP LOCAL LANDOWNERS INFORMED IN TIMELY FASHION OF ANY LANE CLOSURES WHICH WILL RESTRICT THE NORMAL FLOW OF TRAFFIC. THERE WILL BE NO DIRECT PAYMENT FOR THIS WORK.

16. THE CONTRACTOR SHALL MAINTAIN UP TO DATE SETS OF AS-BUILT PLANS FOR THE PROJECT. THESE PLANS SHALL BE KEPT CURRENT; WITHIN FIFTEEN (15) DAYS, AT ALL TIMES AND SHALL BE SUBJECT TO REVIEW BY THE OWNER'S REPRESENTATIVE OR DESIGNEE THROUGHOUT THE PROJECT AND WILL BE REVIEWED BY THE OWNER'S REPRESENTATIVE OR DESIGNEE FOR ACCURACY AND COMPLETENESS AT LEAST ONCE EVERY 15 DAYS. THE FINAL AS-BUILT PLANS SHALL BE SUBMITTED TO THE OWNER'S REPRESENTATIVE OR DESIGNEE PRIOR TO FINAL PAYMENT.

17. ALL WORK IN THE VICINITY OF LIVE STREAMS, WATER IMPOUNDMENTS, WETLANDS OR IRRIGATION SUPPLIES SHALL BE AFFECTED IN SUCH A MANNER AS TO MINIMIZE VEGETATION REMOVAL, SOIL DISTURBANCE AND EROSION. CROSSINGS OF LIVE STREAMS WITH HEAVY EQUIPMENT SHALL BE MINIMIZED, AS DETERMINED BY THE OWNER'S REPRESENTATIVE OR DESIGNEE. EQUIPMENT REFUELING, MAINTENANCE AND CEMENT DUMPING IN THE VICINITY OF WATER COURSES IS STRICTLY PROHIBITED AND SHALL BE PERFORMED IN PROPER CONTAINMENT AREAS.

18. TOPOGRAPHY SHOWN ON THESE PLANS IS ACCORDING TO FIELD LOCATION BY NCE SURVEYS, INC. JAMES C. EDWARDS P.L.S. #15269, DATED AUGUST 22, 2018.

19. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL REMOVALS REQUIRED TO COMPLETE THE PROJECT. ADDITIONAL REMOVALS NOT SHOWN ON THE PLANS WILL BE DESIGNATED BY THE OWNER'S REPRESENTATIVE OR DESIGNEE. THIS WORK WILL BE CONSIDERED AS INCLUDED IN THE CONTRACT PRICE FOR REMOVAL OF STRUCTURES AND OBSTRUCTIONS AND THE CONTRACTOR WILL NOT RECEIVE ADDITIONAL COMPENSATION FOR UNLISTED REMOVALS.

20. UNSUITABLE CONSTRUCTION MATERIALS AND DEBRIS FROM CLEARING AND GRUBBING ARE TO BE PLACED IN AN ENVIRONMENTALLY SUITABLE DISPOSAL SITE.

21. UTILITY LOCATIONS SHOWN WITHIN THE PROJECT BOUNDARY ARE BASED UPON THE BEST AVAILABLE EVIDENCE, BUT THE POSITIONS ARE NOT WARRANTED TO BE ACCURATE. CONTACT UTILITY PROVIDERS BEFORE STARTING ANY EXCAVATION WORK. SHOULD CONFLICTING INFORMATION OR INTERFERENCE PROBLEMS APPEAR IN THE CONSTRUCTION DRAWINGS THE CONTRACTOR SHALL BRING THAT INFORMATION TO THE ATTENTION OF THE ENGINEER IMMEDIATELY PRIOR TO INSTALLATION. FAILURE TO DO SO SHALL NOT BE A BASIS OF EXTRA PAYMENT TO THE CONTRACTOR.

22. THE CONTRACTOR SHALL NOTIFY ALL UTILITY COMPANIES BEFORE COMMENCING WORK AND SHALL BE RESPONSIBLE FOR COMPLYING WITH NEW MEXICO ONE-CALL PROCEDURES. ANY DAMAGE TO EXISTING UTILITIES MUST BE IMMEDIATELY REPORTED TO THE APPROPRIATE UTILITY COMPANY.

23. NEW MEXICO 811 LOCATES SHALL BE FIELD VERIFIED BY THE CONTRACTOR THROUGH POTHOLING AND COORDINATION WITH UTILITY OWNER.

24. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING THE RESPECTIVE UTILITY COMPANIES PRIOR TO GRADING OR TRENCHING.

25. THE CONTRACTOR SHALL REVIEW AND FOLLOW THE RECOMMENDATIONS PROVIDED IN THE "GEOTECHNICAL ENGINEERING REPORT STUDY WLU REMOTE FACILITY FRAKING WATER POND" SAN JUAN COUNTY, NEW MEXICO, PREPARED BY GEOMAT INC., DATED JULY 6, 2018 FOR MOISTURE CONTENT, MAXIMUM COMPACTED LIFT DEPTHS, AND MINIMUM COMPACTION REQUIREMENTS FOR THE PROJECT.

26. THE CONTRACTOR SHALL CONFORM TO ALL REQUIREMENTS SET FORTH BY THE TECHNICAL SPECIFICATIONS LOCATED IN THE PROJECT MANUAL.

27. TRENCHES DEEPER THAN 5' IN DEPTH MUST BE SHORED, SLOPED, OR SHIELDED PER OSHA REGULATIONS.

28. EARTHWORK ESTIMATES ARE BASED ON COMPACTED AND IN-PLACE MATERIAL. CONTRACTOR IS RESPONSIBLE FOR PROVIDING THE REQUIRED MATERIAL AND HAUL ASSETS TO EMPLACE AND REMOVE THE CORRECT VOLUMES USING LOOSE SOIL CORRECTION FACTORS. NO SEPARATE MEASUREMENT OR PAYMENT WILL BE MADE THEREFORE.

29. PLACE AND COMPACT FILL IN HORIZONTAL LIFTS, USING EQUIPMENT AND PROCEDURES THAT WILL PRODUCE RECOMMENDED MOISTURE CONTENTS AND DENSITIES THROUGHOUT THE LIFT.

UN-COMPACTED FILL LIFTS SHOULD NOT EXCEED 10 INCHES LOOSE THICKNESS.

MATERIALS SHOULD BE COMPACTED TO THE FOLLOWING:

MINIMUM PERCENT	
MATERIAL	(ASTM D698)
LINER SUBGRADE	PER LINER MANUFACTURER'S RECOMMENDATIONS
SUBGRADE SOILS BENEATH FILL AREAS	95
ON SITE OR IMPORTED SOIL FILLS:	
BENEATH FOOTINGS AND SLABS ON GRADE	95
AGGREGATE BASE BENEATH SLABS AND PAVEMENTS	95
MISCELLANEOUS BACKFILL	90

ON-SITE AND IMPORTED SOILS SHOULD BE COMPACTED AT MOISTURE CONTENTS NEAR OPTIMUM.
EMBANKMENT FILLS SHOULD BE COMPACTED TO A MINIMUM 95 PERCENT OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D698 AT NEAR OPTIMUM MOISTURE CONTENT IN LIFTS NOT EXCEEDING 10-INCHES IN LOOSE THICKNESS.

30. BACKFILL MATERIALS TO BE PLACED UNDER CONCRETE SLABS SHALL COMPLY WITH ALL APPLICABLE TECHNICAL SPECIFICATIONS. EXPANSIVE TYPE SOILS ARE PROHIBITED AS BACKFILL MATERIALS.

31. THE EARTHWORK HAUL ON THIS PROJECT WILL BE CONSIDERED AS INCLUDED IN THE CONTRACT PRICE FOR UNCLASSIFIED EXCAVATION AND BORROW AS APPLICABLE, AND NO SEPARATE MEASUREMENT OR PAYMENT WILL BE MADE THEREFORE.

32. THE PROJECT WILL HAVE ALTERATION, VERIFICATION, AND SUBGRADE DENSITY TESTS COMPLETED BY A GEOTECHNICAL ENGINEERING COMPANY TO VERIFY COMPACTION. PROOF ROLLING WILL BE COMPLETED ALONG THE PROJECT SUBGRADE AND ANY SOFT SPOTS WILL BE REMOVED AND RECONSTRUCTED BEFORE THE CONTRACTOR BEGINS WORK.

33. NOTWITHSTANDING THE APPROVAL OF THESE GRADING PLANS, THE CONTRACTOR IS RESPONSIBLE FOR THE PREVENTION OF DAMAGE TO ADJACENT PROPERTY. NO PERSON SHALL EXCAVATE ON LAND SO CLOSE TO THE PROPERTY LINE AS TO ENDANGER ANY SUCH PROPERTY FROM SETTLING, CRACKING, EROSION, SILTING, SCOUR OR OTHER DAMAGE, WHICH MIGHT RESULT FROM THE GRADING DESCRIBED ON THE PLAN.

34. SPECIAL CONDITION: IF ANY ARCHEOLOGICAL RESOURCES ARE DISCOVERED ON THE SITE OF THIS GRADING OPERATION, SUCH OPERATION WILL CEASE IMMEDIATELY, AND THE PERMITTEE WILL NOTIFY THE OWNER'S REPRESENTATIVE.

35. ALL PROJECT LIMITS AND CONSTRUCTION AREAS SHALL BE CLEARLY DELINEATED IN THE FIELD PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION AND/OR GRADING.

36. DURING ROUGH GRADING OPERATIONS AND PRIOR TO THE CONSTRUCTION OF ANY PERMANENT DRAINAGE STRUCTURES, TEMPORARY DRAINAGE CONTROL SHALL BE PROVIDED TO PREVENT PONDING WATER AND DAMAGE TO CONTIGUOUS PROPERTIES.

37. NO OBSTRUCTION OF FLOOD PLAINS OR NATURAL WATER COURSES WILL BE PERMITTED.

38. ALL EXISTING DRAINAGE COURSES ON THE PROJECT SITE MUST CONTINUE TO FUNCTION DURING STORM CONDITIONS. PROTECTIVE MEASURERS AND TEMPORARY DRAINAGE PROVISIONS MUST BE USED TO PROTECT CONTIGUOUS PROPERTIES DURING GRADING OPERATIONS.

39. THE FINISHED GRADE SHALL BE SLOPED AWAY FROM ALL EXTERIOR BUILDING WALLS AND FACILITIES TO PROMOTE POSITIVE DRAINAGE AWAY FROM FOUNDATIONS.

40. SAN JUAN COUNTY SHALL BE NOTIFIED 72 HOURS PRIOR TO COMMENCING ANY WORK IN THE PUBLIC RIGHT OF WAY.

41. ROADWAY SECTION REPLACEMENT SHALL MEET CURRENT SAN JUAN COUNTY AND UNITED STATES BUREAU OF LAND MANAGEMENT GOLD BOOK STANDARDS FOR DEPTH OR MATCH EXISTING DEPTH, WHICHEVER IS THICKER.

42. RECORD DRAWINGS OR WORK COMPLETED SHALL BE SUBMITTED TO ENGINEER PRIOR TO FINAL ACCEPTANCE OF THE INSTALLATIONS.

43. IN THE EVENT A SERVICE OUTAGE IS REQUIRED, CONTRACTOR WILL NOTIFY ALL AFFECTED PARTIES WHEN AND HOW LONG THEY WILL BE WITHOUT SERVICE.

44. OWNER WILL ENSURE THAT ALL INSTALLED EROSION AND SEDIMENTATION CONTROL MEASURES COMPLY WITH THEIR EXISTING ASSET STORMWATER POLLUTION PREVENTION PLAN (SWPPP).

45. EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE IMPLEMENTED AND SHALL BE KEPT IN PLACE UNTIL EROSION AND SEDIMENTATION POTENTIAL IS MITIGATED. REMOVAL OF SILT AND SEDIMENT IS REQUIRED ONCE SILT AND SEDIMENT HAS REACHED HALF THE HEIGHT OF THE SILT FENCE. EROSION AND SEDIMENTATION CONTROL DEVICES SHALL BE CHECKED AND MAINTAINED PER THE OWNERS PERMIT.

46. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD.

47. THE CONTRACTOR SHALL COORDINATE STRUCTURAL DRAWINGS WITH OTHER DRAWINGS FOR INDIVIDUAL ITEMS. DISCREPANCIES UNCOVERED, IF ANY, SHALL BE REPORTED BEFORE PROCEEDING WITH THE WORK SO THAT PROPER ADJUSTMENT CAN BE MADE.

48. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING SAFE AND ADEQUATE SHORING FOR ALL PARTS OF THE PROJECT DURING CONSTRUCTION. ALL STRUCTURES SHOWN ON THE DRAWINGS HAVE BEEN DESIGNED FOR STABILITY UNDER FINAL CONFIGURATION.

49. THE OWNER WILL PROVIDE CONSTRUCTION OBSERVERS AND MATERIAL TESTERS TO OBSERVE AND TEST ALL CONTROLLED EARTHWORK. THE CONSTRUCTION OBSERVERS AND MATERIAL TESTERS SHALL PROVIDE CONTINUOUS ON-SITE OBSERVATION AND TESTING DURING CONSTRUCTION OF CONTROLLED EARTHWORK. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION OBSERVERS AND MATERIAL TESTERS AT LEAST TWO WORKING DAYS IN ADVANCE OF ANY FIELD OPERATIONS OF THE CONTROLLED EARTHWORK.

50. CONTRACTOR SHALL COMPLY WITH ANY AND ALL CONDITIONS OF APPROVALS ISSUED BY THE REGULATORY AGENCIES AS DETERMINED BY OWNER.

51. ENGINEER HAS NO CONTROL OVER COST OF LABOR, MATERIALS, EQUIPMENT OR SERVICES FURNISHED BY OTHERS. COMPETITIVE BIDDING OR MARKET CONDITIONS.

FACILITY/PIT OWNER

ENDURING RESOURCES
332 COUNTY ROAD 3100
AZTEC, NEW MEXICO, 87410
(505) 386-8887

CIVIL ENGINEER

HEATHER D. MCDANIEL, P.E.
SOUDER, MILLER & ASSOCIATES (SMA)
8000 WEST FOURTEENTH AVENUE
LAKEWOOD, COLORADO 80214
(303) 239-9011

SURFACE OWNER

BUREAU OF LAND MANAGEMENT
5251 COLLEGE BLVD, SUITE A
FARMINGTON, NEW MEXICO 87402
(505) 564-7600

ABBREVIATIONS

BLM	BUREAU OF LAND MANAGEMENT	N.T.S.	NOT TO SCALE
CMP	CORRUGATED METAL	O.C.	ON CENTER
CU. FT.	CUBIC FEET	SQ. FT.	SQUARE FEET
CU. YD.	CUBIC YARDS	STA.	STATION
DIA.	DIAMETER (Ø)	TOE	TOE OF BANK
ELEV.	ELEVATION	TOP	TOP OF BANK
EX	EXISTING	TYP	TYPICAL
FT	FEET	w/	WITH
FG	FINISH GRADE		
HORIZ	HORIZONTAL		
LF	LINEAR FEET		
LLDPE	LINEAR LOW-DENSITY POLYETHYLENE		
MAX.	MAXIMUM		
ME	MATCH EXISTING		
MCC	MECHANICAL CONTROL CENTER		
MIL or MM	MILLIMETER		
MIN.	MINIMUM		

LEGEND

- EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- PROPOSED INDEX CONTOURS
- PROPOSED INTERMEDIATE CONTOURS
- PROPOSED DRAINAGE PIPE
- PROPOSED CHAIN LINK FENCE
- PROPOSED MAN WAY PEDESTRIAN GATE

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ENDURING RESOURCES

SAN JUAN COUNTY, NM

ENDURING RESOURCES WLU 2309-24N WATER RECYCLE FACILITY GENERAL NOTES AND LEGEND

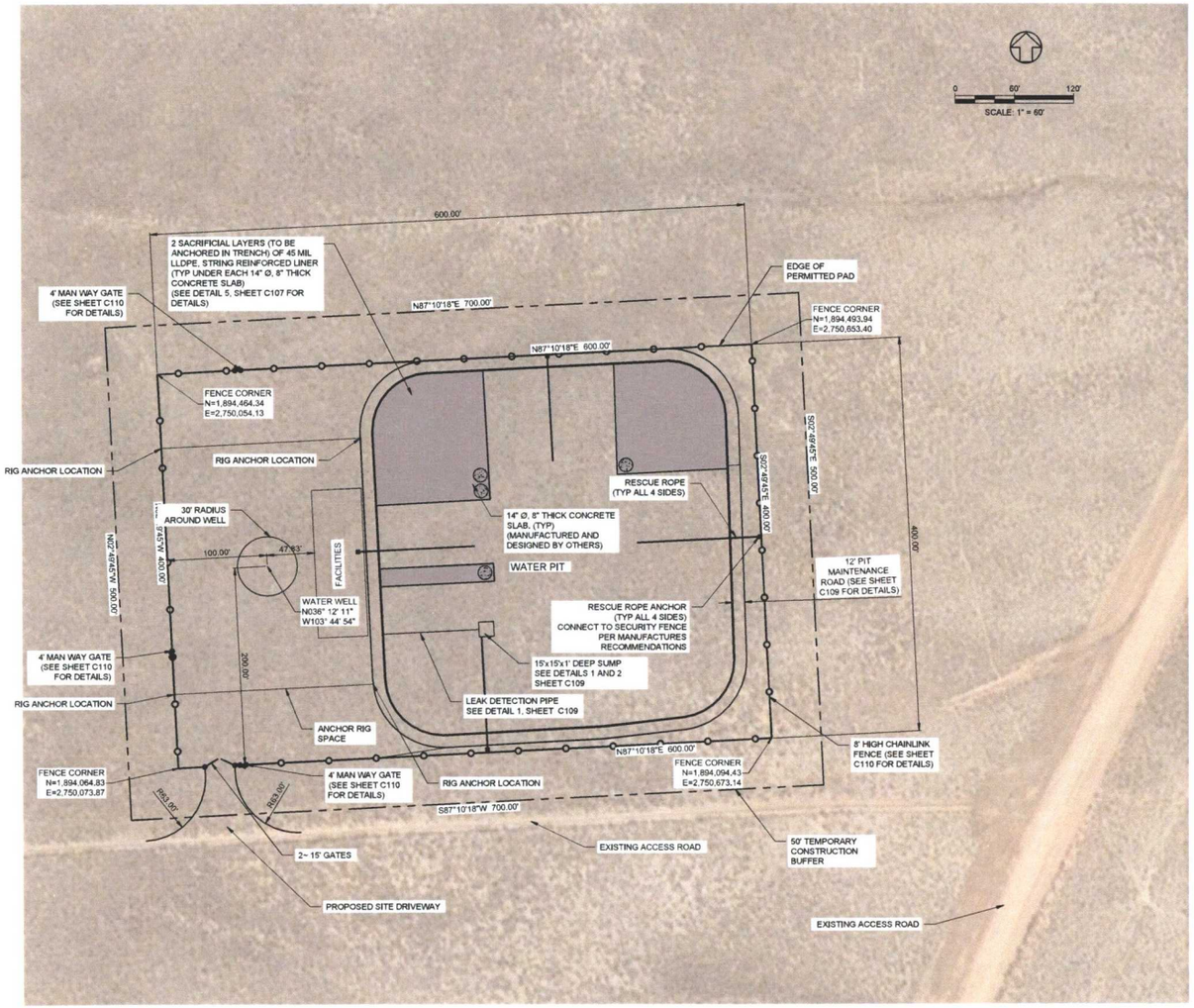
NEW MEXICO 22047 PROFESSIONAL ENGINEER 8-29-2018

THIS DRAWING IS INCOMPLETE AND NOT TO BE USED FOR CONSTRUCTION UNLESS IT IS STAMPED, SIGNED AND DATED.

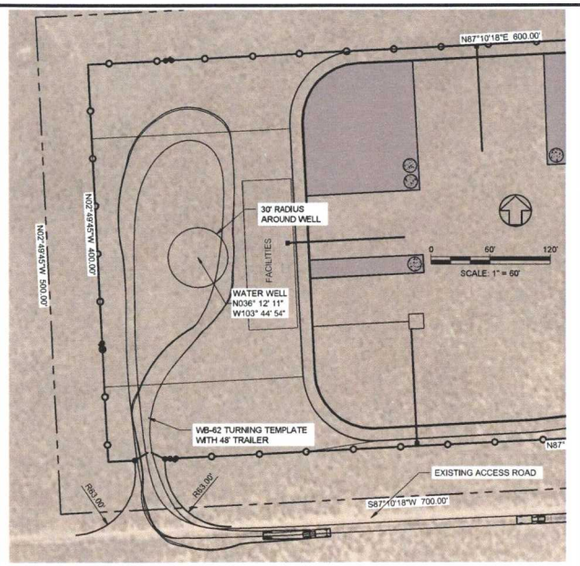
Designed	Drawn	Checked
HDM	GJF	HDM

Date: September 2018
Scale: Horiz: N/A Vert: N/A
Project No: 9127383
Sheet: G101

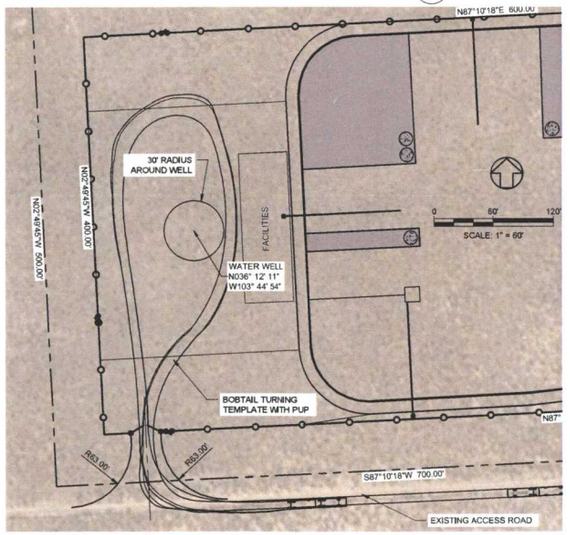
nm811 Know what's below. Call before you dig.



SITE MAP (1 / C101)



WB-62 TURNING TEMPLATE (2 / C101)



BOBTAIL AND PUP TURNING TEMPLATE (3 / C101)

NOTE:
STOCKPILING OF TOP SOIL: CONTRACTOR SHALL SEGREGATE AND STOCKPILE ALL TOPSOIL OUTSIDE OF THE CONSTRUCTION AREA WITH APPROPRIATE SEDIMENT CONTROL. TOP SOIL SHALL BE REDISTRIBUTED ON THE OUTSIDE OF CONSTRUCTED BERMS, AND EITHER SEEDED, AND MULCHED OR PROTECTED WITH EROSION CONTROL MEASURES, REFER TO CONSTRUCTION PLANS FOR DETAILS.

PROPOSED POND INFORMATION:

TOP OF BERM ELEVATION (3' FREEBOARD):	6873.66FT
WATER SURFACE ELEVATION:	6870.66 FT
WATER SURFACE AREA (ELEVATION 6871.00)	114,798 SQ. FT. (2.64 ACRES)
POND STORAGE VOLUME:	53,949 CU. YD. (259, 435 BBLS)

By	Check	Rev #	Date	Description

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ENDURING RESOURCES

SAN JUAN COUNTY, NM

ENDURING RESOURCES WLU 2309-24N WATER RECYCLE FACILITY SITE MAP

NEW MEXICO 22047 PROFESSIONAL ENGINEER 7-29-2018

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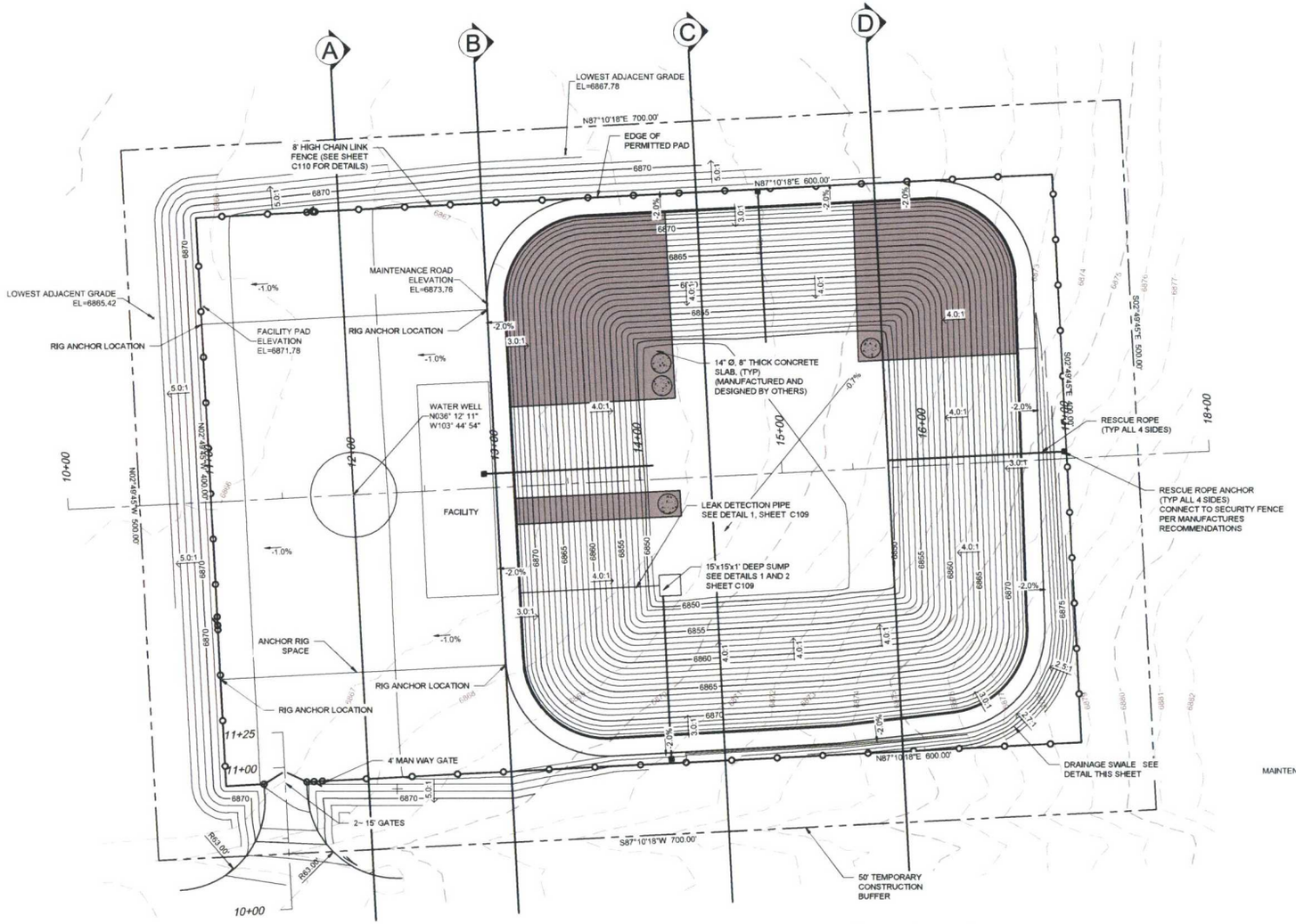
Sheet: C101

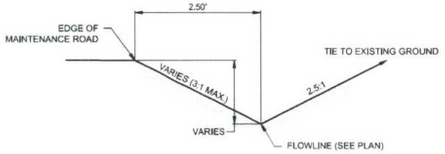
811 New Mexico Believes. Call before you dig.

P:\5-Enduring Resources - 16B Pond Design (5127383)\CAD\Civil\W LYBROOK\5127383 WLU SITE PLAN.dwg, 9/27/2018 1:48:12 PM GJF



0 40' 80'

SCALE: 1" = 40'



TYPICAL DITCH SECTION (1 / C102)

N.T.S.

On-Site Drainage	Area (ACRES)	NRCS Soil Types	Percent Imperviousness	Methodology for Analysis	Time of Concentration (MINUTES)	2-Year, 24-Hour Flow Rate (CFS)	5-Year, 24-Hour Flow Rate (CFS)	10-Year, 24-Hour Flow Rate (CFS)	25-Year, 24-Hour Flow Rate (CFS)	50-Year, 24-Hour Flow Rate (CFS)	100-Year, 24-Hour Flow Rate (CFS)	NOTE
Pre-Development Area	6.5	A	2	Rational Method	35.41	0.03	0.05	0.07	0.14	0.61	2.08	Historical
Post-Development Pad Area	3.6	A	50	Rational Method	20.42	1.26	1.77	2.23	3.04	3.91	4.92	Post Development

Rainfall Impact on Pit Freeboard			
Storm Event	Stormwater Volume (CF)	Pit Volume Increase (CF)	Impact on Freeboard (FT)
Maximum Storage	978,318.00	0	0.000
25-Yr, 24-Hr	14,472.81	992,790.81	0.006
50-Yr, 24-Hr	16,707.60	1,009,498.41	0.010
100-Yr, 24-Hr	19,048.77	1,028,547.18	0.011

NOTE:
STOCKPILING OF TOP SOIL: CONTRACTOR SHALL SEGREGATE AND STOCKPILE ALL TOPSOIL OUTSIDE OF THE CONSTRUCTION AREA WITH APPROPRIATE SEDIMENT CONTROL. TOP SOIL SHALL BE REDISTRIBUTED ON THE OUTSIDE OF CONSTRUCTED BERMS, AND EITHER SEEDED, AND MULCHED OR PROTECTED WITH EROSION CONTROL MEASURES.

PROPOSED SITE EARTHWORK:

APPROXIMATE CUT:	53,297 CU. YD. (APPROXIMATELY 41,946 CU. YD. SANDSTONE)
APPROXIMATE FILL:	25,798 CU. YD.
APPROXIMATE NET CUT:	27,499 CU. YD.
TOPSOIL REMOVAL (0.50' DEPTH)	5,021 CU. YD

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ENDURING RESOURCES

SAN JUAN COUNTY, NM

ENDURING RESOURCES WLU 2309-24N WATER RECYCLE FACILITY

SITE GRADING AND DRAINAGE PLAN

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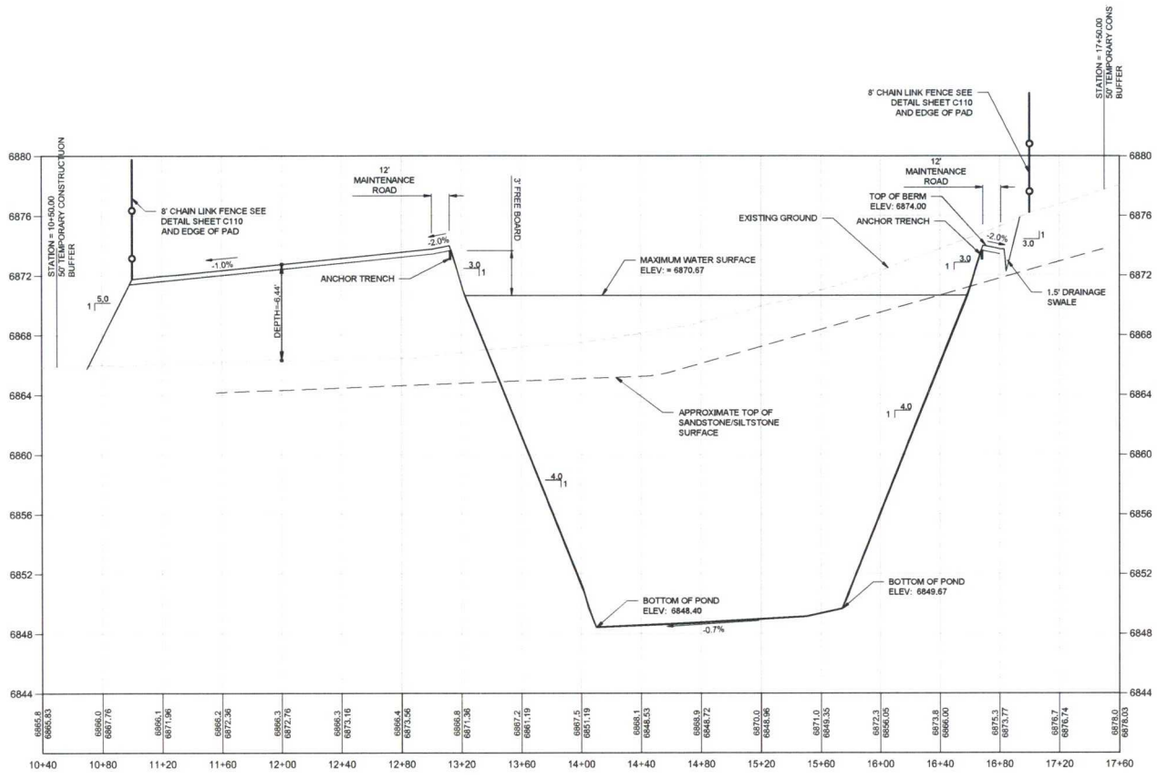
Scale: Horiz.
Vert.

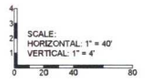
Project No: 9127383

Sheet: C102



SITE PROFILE
STA 10+40 - STA 17+60

NOTE:
1. ON-SITE AND IMPORTED SOILS SHOULD BE COMPACTED AT MOISTURE CONTENTS NEAR OPTIMUM. EMBANKMENT FILLS SHOULD BE COMPACTED TO A MINIMUM 95 PERCENT OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D698 AT NEAR OPTIMUM MOISTURE CONTENT IN LIFTS NOT EXCEEDING 10-INCHES IN LOOSE THICKNESS.



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ENDURING RESOURCES

SAN JUAN COUNTY, NM

ENDURING RESOURCES WLU 2309-24N WATER RECYCLE FACILITY
SITE PROFILE

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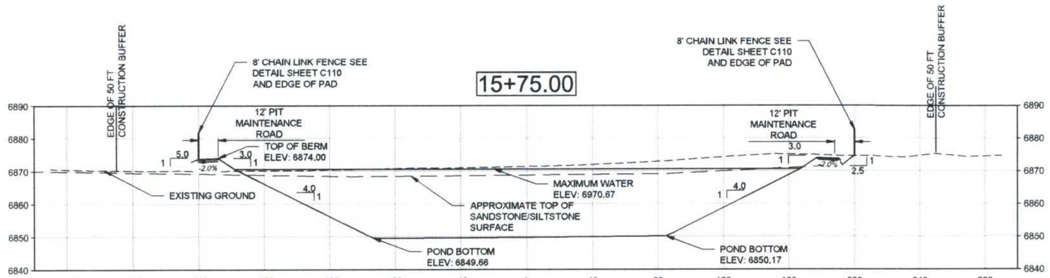
Designed	Drawn	Checked
HDM	GJF	HDM

Date: September 2018

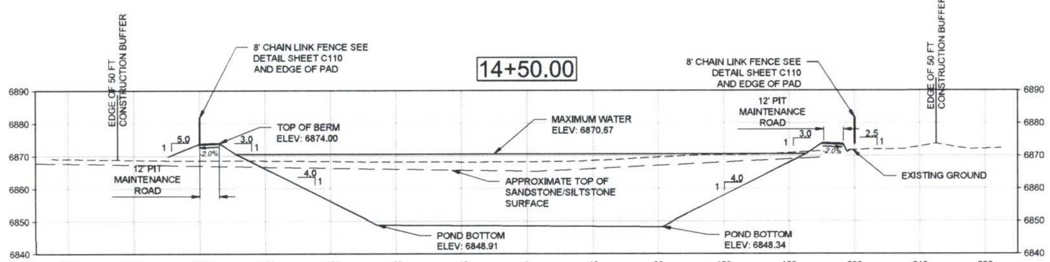
Scale: Horiz:
Vert:

Project No: 9127383

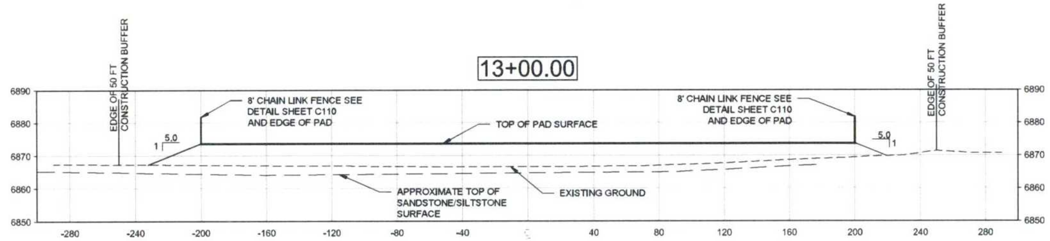
Sheet: C103



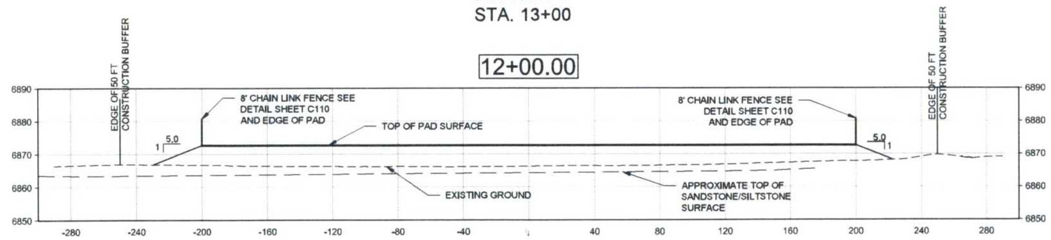
SECTION D
STA. 16+00



SECTION C
STA. 14+50



SECTION B
STA. 13+00



SECTION A
STA. 12+00

SCALE:
HORIZONTAL: 1" = 40'
VERTICAL: 1" = 20'

NOTE:
1. ON-SITE AND IMPORTED SOILS SHOULD BE COMPACTED AT MOISTURE CONTENTS NEAR OPTIMUM. EMBANKMENT FILLS SHOULD BE COMPACTED TO A MINIMUM 95 PERCENT OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D698 AT NEAR OPTIMUM MOISTURE CONTENT IN LIFTS NOT EXCEEDING 10-INCHES IN LOOSE THICKNESS.

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ENDURING RESOURCES
SAN JUAN COUNTY, NM

ENDURING RESOURCES WLU 2309-24N
WATER RECYCLE FACILITY
SITE CROSS-SECTIONS

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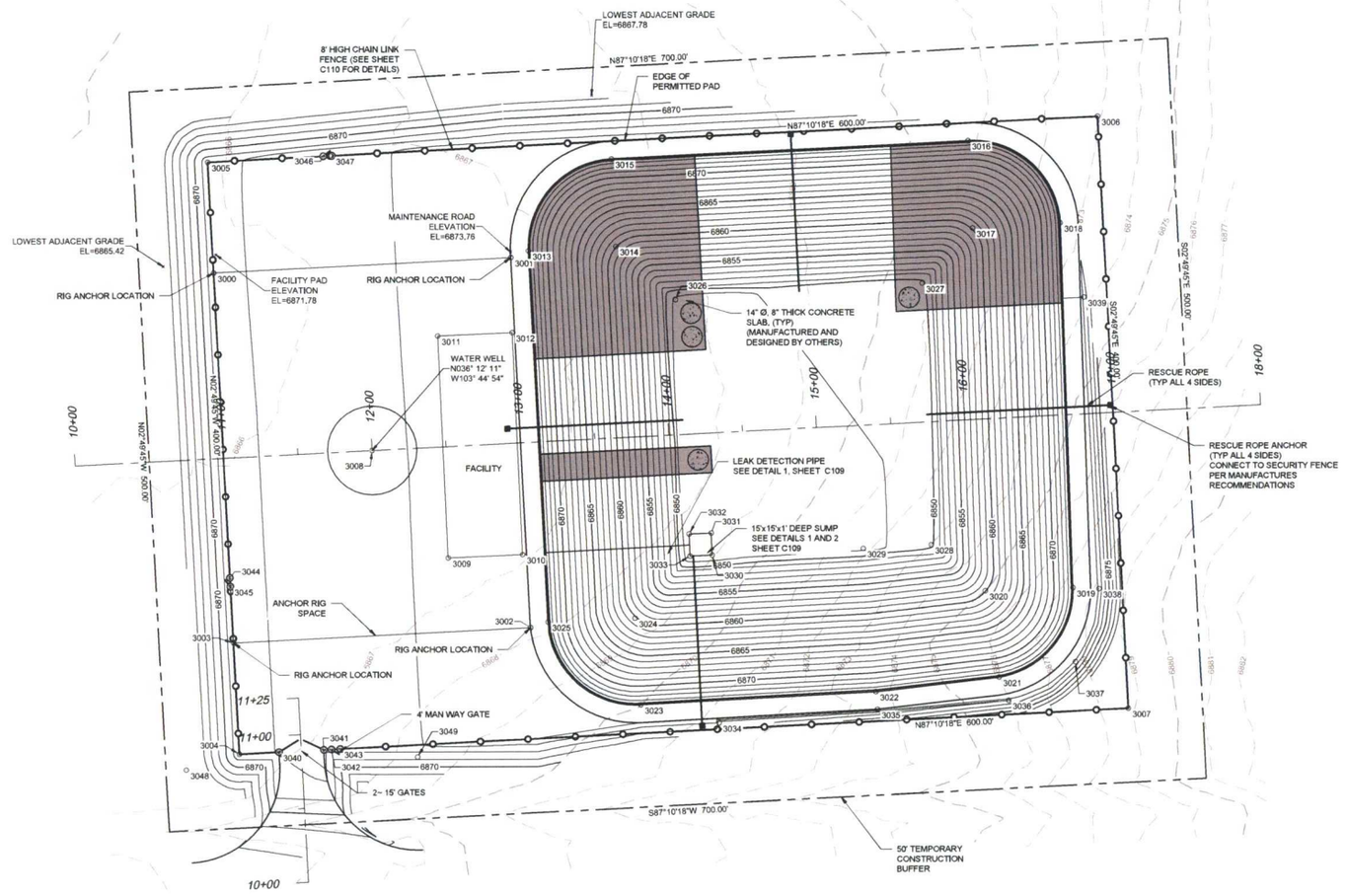
Designed	Drawn	Checked
HDM	GJF	HDM

Date: September 2018
Scale: Horiz: Vert:
Project No: 9127383
Sheet: C104

P:\5-Enduring Resources - 16B Pond Design (5127383)\CAD\Civil\W LYBROOK\5127383 WLU GRADING AND DRAINAGE.dwg, 9/27/2018 1:48:47 PM GJF



0 40' 80'

SCALE: 1" = 40'

Point Table				
POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
3000	1894389.53	2750057.91	6871.76	RIG ANCHOR
3001	1894399.40	2750257.66	6873.76	RIG ANCHOR
3002	1894149.71	2750270.00	6873.76	RIG ANCHOR
3003	1894139.83	2750070.25	6871.76	RIG ANCHOR
3004	1894064.83	2750073.87	6871.76	FENCE CORNER
3005	1894464.34	2750054.13	6871.76	FENCE CORNER
3006	1894493.94	2750653.40	6872.91	FENCE CORNER
3007	1894094.43	2750673.14	6878.84	FENCE CORNER
3008	1894269.62	2750163.95	6872.76	WATER WELL
3009	1894196.79	2750214.96	6873.23	FACILITY
3010	1894198.98	2750264.91	6873.73	FACILITY
3011	1894346.64	2750208.39	6873.24	FACILITY
3012	1894348.83	2750258.34	6873.74	FACILITY
3013	1894403.89	2750269.45	6874.00	TOP OF POND
3014	1894406.80	2750328.38	6860.12	59' RADIUS
3015	1894465.73	2750325.47	6874.00	TOP OF POND
3016	1894477.61	2750566.07	6874.00	TOP OF POND
3017	1894418.69	2750568.98	6860.18	59' RADIUS
3018	1894422.08	2750627.88	6874.00	TOP OF POND
3019	1894175.72	2750635.78	6874.00	TOP OF POND
3020	1894173.84	2750576.86	6859.91	59' RADIUS
3021	1894115.54	2750585.91	6874.00	TOP OF POND
3022	1894106.04	2750503.12	6874.00	TOP OF POND
3023	1894097.45	2750344.14	6874.00	TOP OF POND
3024	1894155.89	2750340.35	6860.24	59' RADIUS
3025	1894153.45	2750281.83	6874.00	TOP OF POND
3026	1894370.73	2750368.47	6848.67	PIT BOTTOM
3027	1894381.54	2750534.81	6849.67	PIT BOTTOM
3028	1894205.10	2750540.47	6849.67	PIT BOTTOM
3029	1894202.70	2750494.90	6848.67	PIT BOTTOM
3030	1894198.26	2750392.78	6848.31	SUMP TOP
3031	1894213.24	2750392.18	6848.27	SUMP TOP
3032	1894212.64	2750377.19	6848.23	SUMP TOP
3033	1894197.65	2750377.79	6848.25	SUMP TOP
3034	1894085.09	2750397.20	6871.03	SWALE
3035	1894094.08	2750504.13	6873.76	SWALE
3036	1894099.91	2750592.43	6872.00	SWALE
3037	1894125.78	2750637.44	6872.26	SWALE
3038	1894175.11	2750653.61	6872.26	SWALE
3039	1894371.92	2750643.88	6872.26	SWALE
3040	1894066.14	2750100.53	6872.03	GATE
3041	1894067.62	2750130.49	6872.33	GATE
3042	1894067.89	2750135.71	6872.38	GATE
3043	1894068.18	2750141.64	6872.44	GATE
3044	1894183.81	2750068.00	6871.76	GATE
3045	1894177.88	2750068.29	6871.76	GATE
3046	1894468.17	2750131.71	6872.54	GATE
3047	1894468.46	2750137.63	6872.60	GATE
3048	1894054.17	2750038.04	6866.62	63' RADIUS
3049	1894062.55	2750193.82	6871.32	63' RADIUS

NOTE:
DATUM COORDINATES ARE NAD83, STATE-PLANE, NEW MEXICO WEST

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SAN JUAN COUNTY, NM

ENDURING RESOURCES WLU 2309-24N WATER RECYCLE FACILITY
SITE HORIZONTAL CONTROL PLAN

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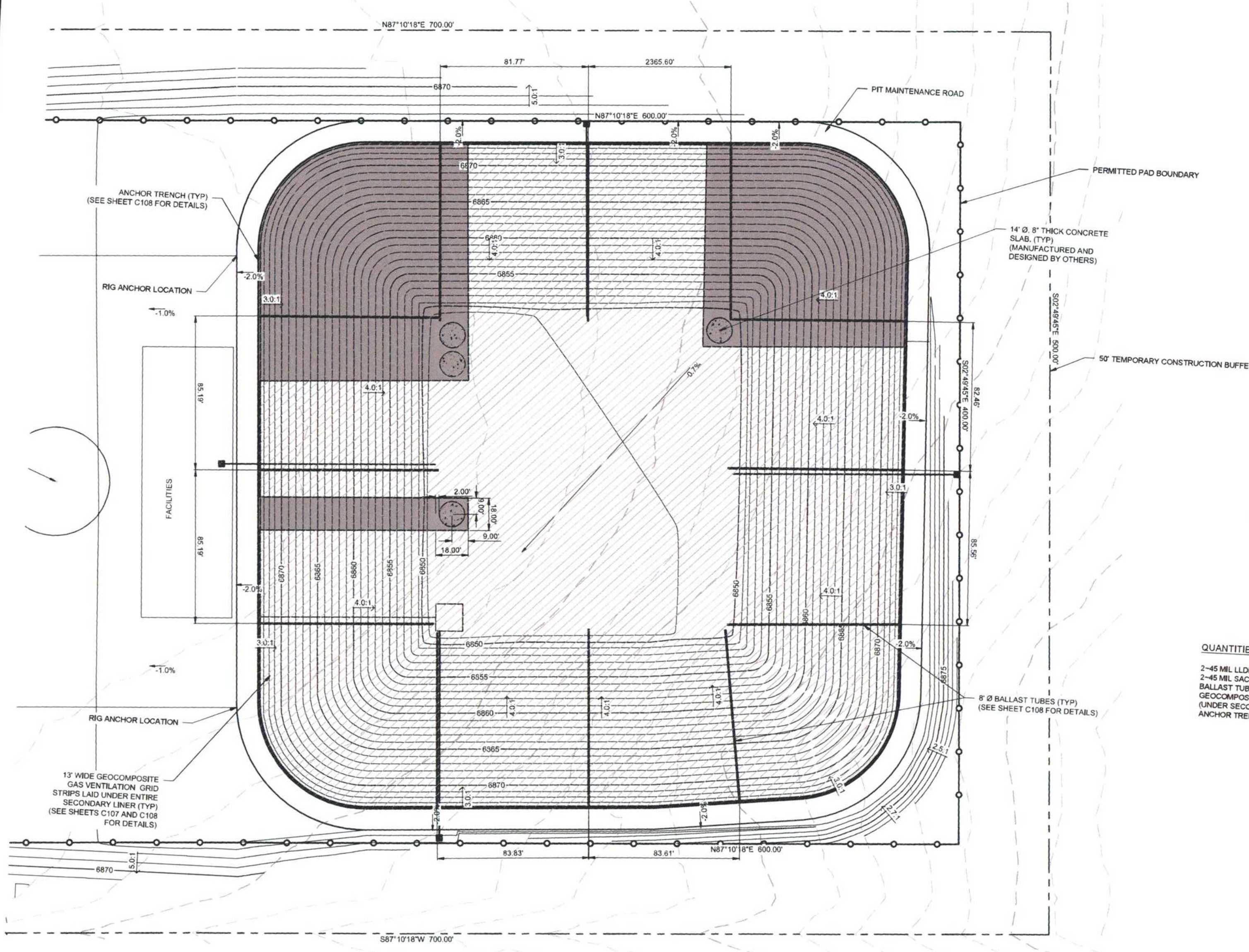
Date: September 2018

Scale: Horiz:
Vert:

Project No: 9127383

Sheet: C105



LEGEND

- LINERS
- 8" Ø BALLAST TUBE
- GEOCOMPOSITE GAS VENTILATION GRID STRIPS UNDER SECONDARY LINER

NOTES:

1. LINERS SHALL COVER PIT BOTTOM, SIDE SLOPES AND END IN THE ANCHOR TRENCH. SEE DETAIL SHEETS C106 AND C107 AND MANUFACTURES SPECIFICATIONS.
2. 8" Ø BALLAST TUBES SHALL BE PLACED AS NOTED.
3. THE PIT GEOCOMPOSITE GAS VENTILATION STRIPS SHALL BE INSTALLED UNDER THE SECONDARY LINER OVER THE ENTIRE BOTTOM AND SIDE SLOPES.

QUANTITIES:

2~45 MIL LLDPE LINERS:	16,884 SQ.YDS. X 2 = 33,688 SQ.YDS.
2~45 MIL SACRIFICIAL LINERS:	3,297 SQ. YDS. X 2 = 6,594 SQ. YDS.
BALLAST TUBES:	1,200 L.F.
GEOCOMPOSITE VENTILATION GRID (UNDER SECONDARY LINER)	10,966 L.F.
ANCHOR TRENCH:	1,340 L.F.

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ENDURING RESOURCES — SAN JUAN COUNTY, NM

ENDURING RESOURCES WLU 2309-24N WATER RECYCLE FACILITY LINER BALLAST TUBES AND PIT GEOCOMPOSITE VENTILATION GRID LAYOUT

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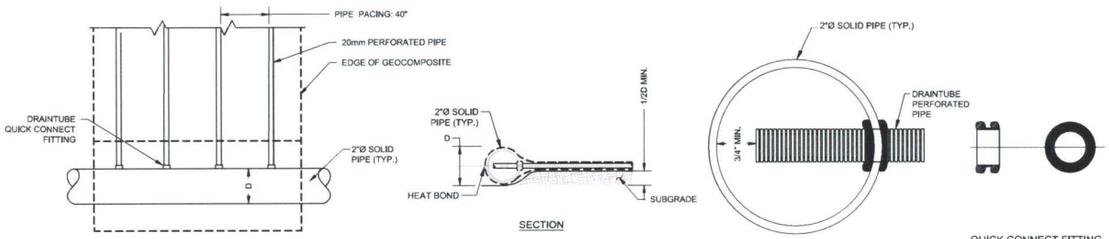
Date: September 2018
Scale: Horiz: Vert:
Project No: 9127383
Sheet: C106

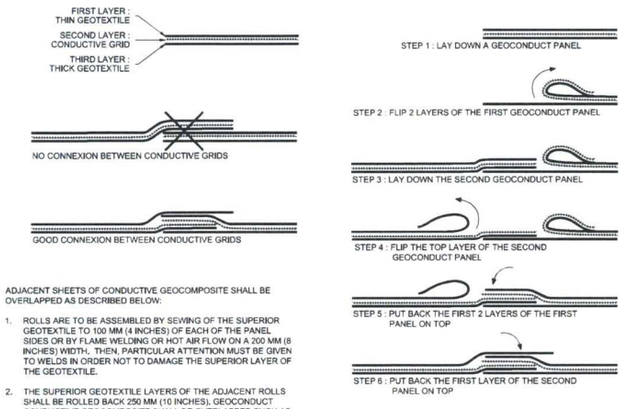
Rev #	Date	Description	By	Chk'd



BERM VENT SIMPLE CONNECTION TO PIPE

N.T.S.

1 / C107



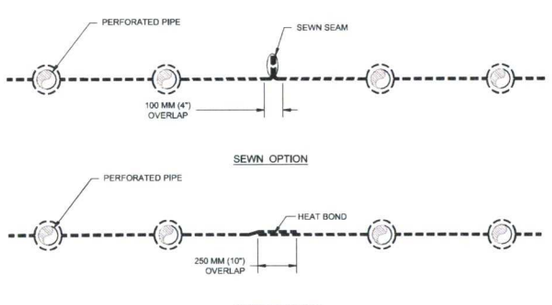
ADJACENT SHEETS OF CONDUCTIVE GEOCOMPOSITE SHALL BE OVERLAPPED AS DESCRIBED BELOW:

1. ROLLS ARE TO BE ASSEMBLED BY SEWING OF THE SUPERIOR GEOTEXTILE TO 100 MM (4 INCHES) OF EACH OF THE PANEL SIDES OR BY FLAME WELDING OR HOT AIR FLOW ON A 200 MM (8 INCHES) WIDTH. THEN, PARTICULAR ATTENTION MUST BE GIVEN TO WELDS IN ORDER NOT TO DAMAGE THE SUPERIOR LAYER OF THE GEOTEXTILE.
2. THE SUPERIOR GEOTEXTILE LAYERS OF THE ADJACENT ROLLS SHALL BE ROLLED BACK 250 MM (10 INCHES), GEOCONDUCT CONDUCTIVE GEOCOMPOSITE SHALL BE OVERLAPPED SUCH AS THE CONDUCTIVE GRIDS MUST BE IN DIRECT CONTACT ON A MINIMUM OF 200 MM (8 INCHES).

CONDUCTIVE GEOCOMPOSITE DETAILS

N.T.S.

2 / C107



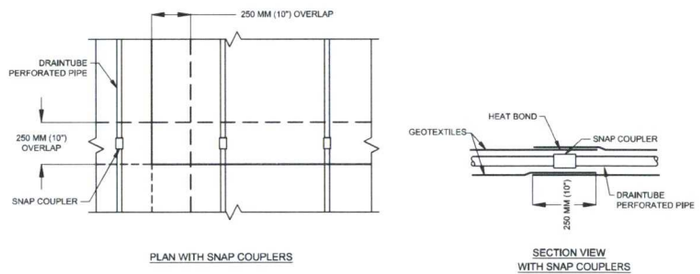
GAS VENTING GEOCOMPOSITE PANEL JOINING OPTIONS FOR SIDE

N.T.S.

3 / C107

NOTE:

DETAILS SHOWN ON THIS PAGE ARE FOR COORDINATION PURPOSES ONLY AND PER MANUFACTURE.



NOTE:
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GAS VENTING GEOCOMPOSITE PANEL JOINING OPTIONS FOR END

N.T.S.

4 / C107

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SANDOVAL COUNTY, NM

ENDURING RESOURCES, SOUTH ESCAVADA WATER CONTAINMENT PIT PROJECT

GEOCOMPOSITE DETAILS

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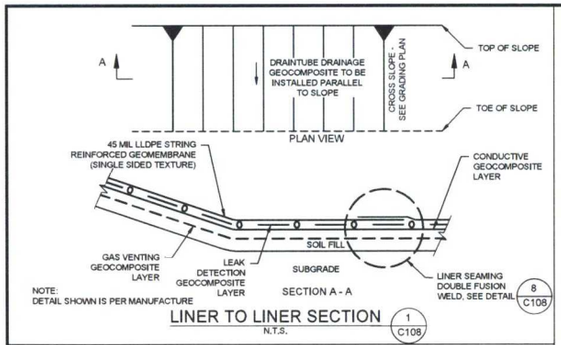
Scale: Horiz: N/A Vert: N/A

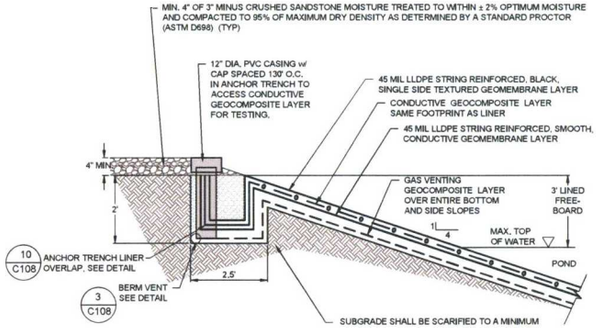
Project No: 5127383

Sheet: C107

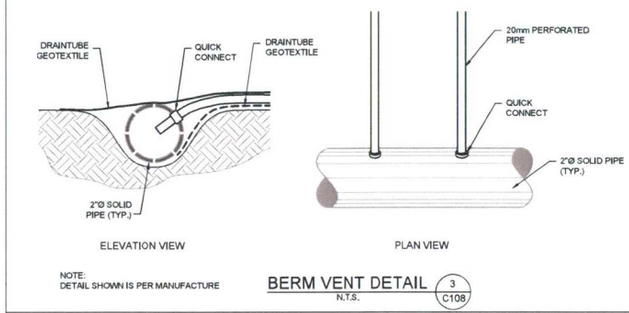


NOTE:
DETAIL SHOWN IS PER MANUFACTURE

LINER TO LINER SECTION 1 C108
N.T.S.

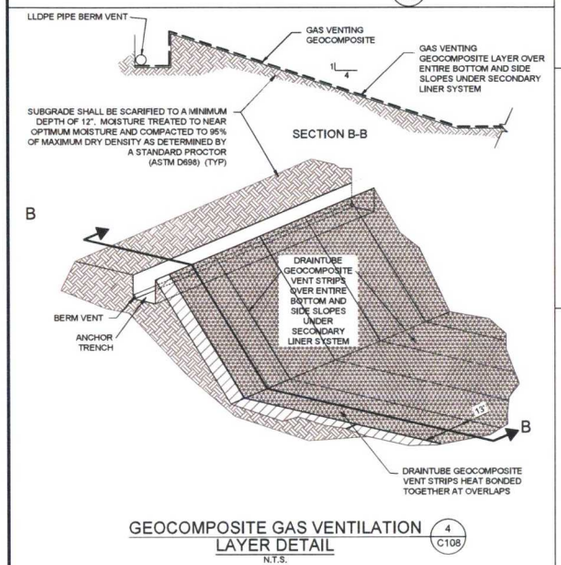


TYPICAL ANCHOR TRENCH DETAIL 2 C108
N.T.S.



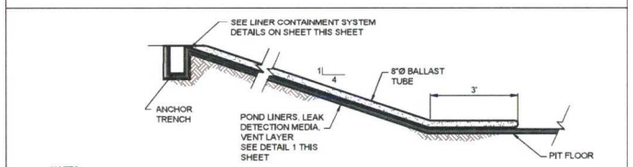
NOTE:
DETAIL SHOWN IS PER MANUFACTURE

BERM VENT DETAIL 3 C108
N.T.S.



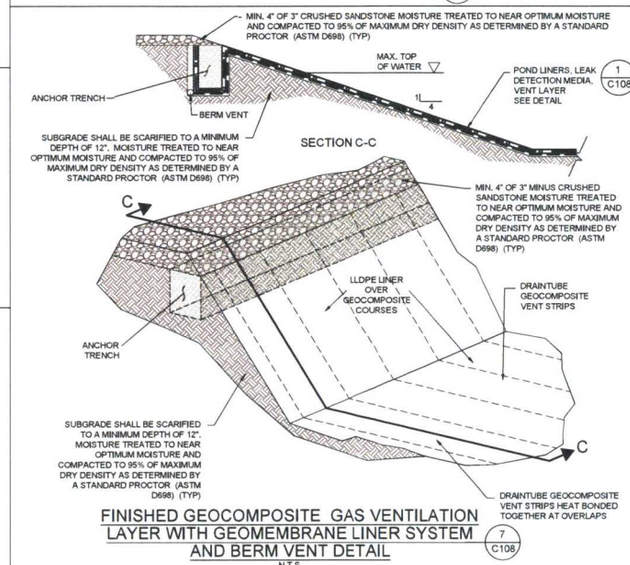
GEOCOMPOSITE GAS VENTILATION LAYER DETAIL 4 C108
N.T.S.

PROTECTION LINER DETAIL 5 C108
N.T.S.

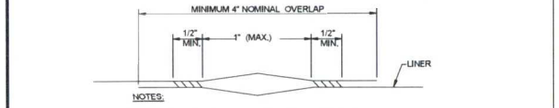


NOTES:
1. BALLAST TUBES TO BE 45-MIL LLDPE OR APPROVED EQUAL.
2. FILL 8"Ø BALLAST TUBES WITH SAND, ANCHOR IN LINER TRENCH AND EXTEND SEVERAL FEET ONTO PIT FLOOR AS NOTED.

BALLAST TUBE DETAILS 6 C108
N.T.S.

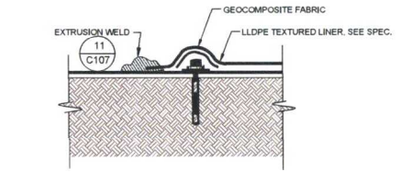


FINISHED GEOCOMPOSITE GAS VENTILATION LAYER WITH GEOMEMBRANE LINER SYSTEM AND BERM VENT DETAIL 7 C108
N.T.S.



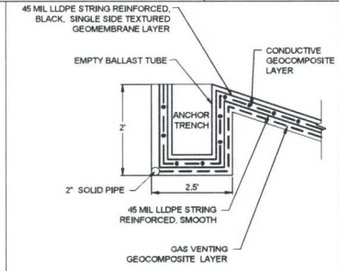
NOTES:
1. LINER SHEETS SHALL BE TACK WELDED TOGETHER AT OVERLAP TO FORM TEMPORARY BOND PRIOR TO WELDING.
2. DOUBLE FUSION WELDING SHALL BE THE PRIMARY SEAMING TECHNIQUE USED.
3. GRINDING NOT TO EXCEED 1/4" PAST "SQUEEZE-OUT" ON EITHER SIDE. PROPER CARE SHOULD BE TAKEN TO INSURE THAT VERY LITTLE MATERIAL IS TAKEN WHEN GRINDING.
4. AIR PRESSURE OR VACUUM TESTING SHALL BE THE NON-DESTRUCTIVE SEAM TEST METHODS FOR DOUBLE FUSION WELDS.
5. SUBGRADE PREPARATION, SELECT FILL (IF REQUIRED) SHALL BE PER LINER MANUFACTURES REQUIREMENTS.
6. DETAIL SHOWN IS PER MANUFACTURE

LINER SEAMING DOUBLE FUSION WELD DETAIL 8 C108
N.T.S.

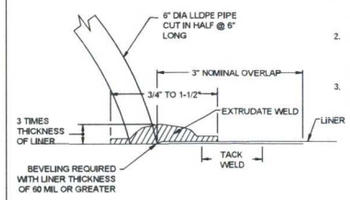


EXTRUSION WELD AT ANCHOR DETAIL 9 C108
N.T.S.

NOTE:
DETAIL SHOWN IS PER MANUFACTURE



ANCHOR TRENCH LINER OVERLAP DETAIL 10 C108
N.T.S.



NOTES:
1. LINER SHEETS TACK WELDED TOGETHER AT OVERLAP TO FORM TEMPORARY BOND PRIOR TO WELDING.
2. GRINDING NOT TO EXCEED 1/4" PAST "SQUEEZE-OUT" ON EITHER SIDE. PROPER CARE SHOULD BE TAKEN IN NOT REMOVING TOO MUCH MATERIAL WHEN GRINDING.
3. VACUUM TESTING IS THE NON-DESTRUCTIVE SEAM TEST METHOD FOR EXTRUSION WELDS.

EXTRUSION WELD DETAIL 11 C108
N.T.S.

NOTE:
DETAIL SHOWN IS PER MANUFACTURE

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SAN JUAN COUNTY, NM

ENDURING RESOURCES

ENDURING RESOURCES WLU 2309-24N WATER RECYCLE FACILITY
LINER AND BALLAST TUBE DETAILS

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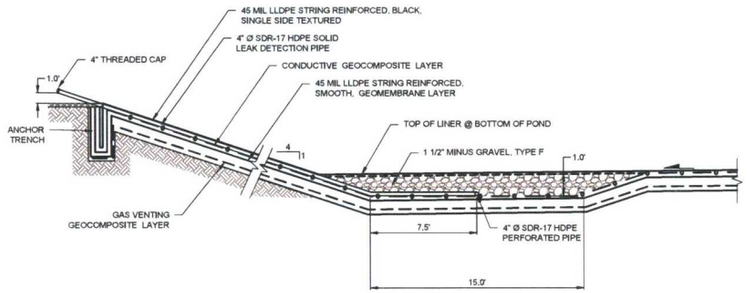
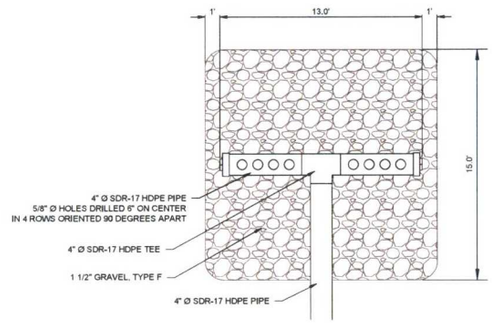
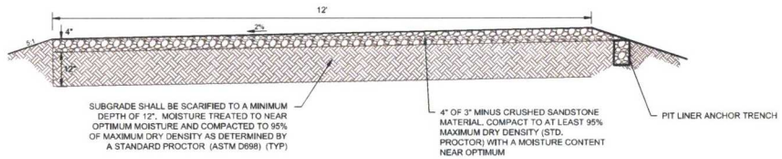
Project No: 9127383
Sheet: C108



PRODUCED WATER PIT LEAK DETECTION
N.T.S.
1 / C109



LEAK DETECTION SYSTEM PIPE DETAIL
N.T.S.
2 / C109



WATER PIT MAINTENANCE ROAD SECTION
N.T.S.
3 / C109

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ENDURING RESOURCES
SAN JUAN COUNTY, NM

ENDURING RESOURCES WLU 2309-24N WATER RECYCLE FACILITY LEAK DETECTION SYSTEM AND PIT MAINTENANCE ROAD DETAILS

NEW MEXICO 22047 PROFESSIONAL ENGINEER
9.27.2018

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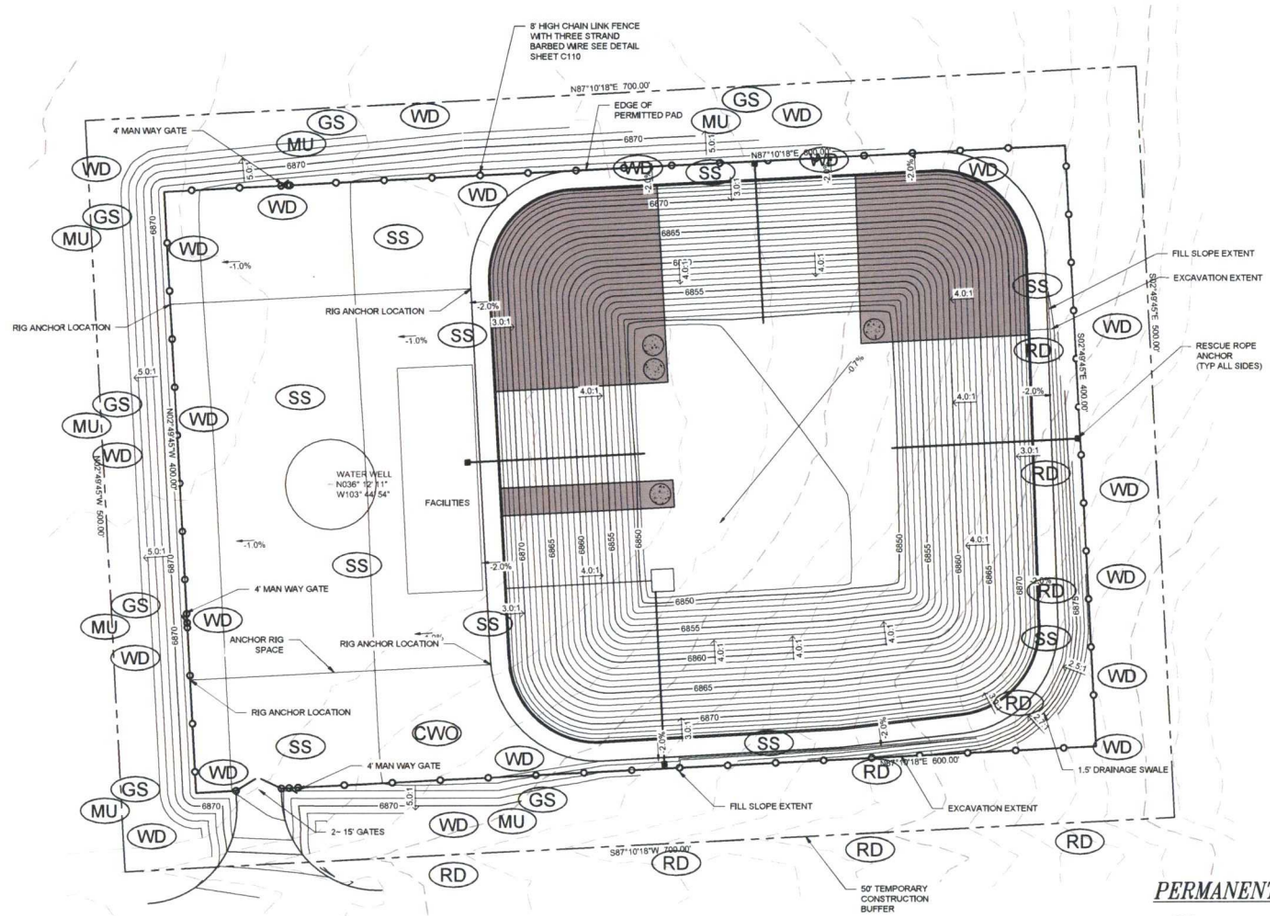
nm811 Know what's below. Call before you dig.



0 40' 80'

SCALE: 1" = 40'

NOTES:

1. ALL FACILITY INFORMATION CAN BE FOUND ON SHEETS C101 AND C102.
2. ALL SLOPES SHALL HAVE WADDLES PLACED.
3. CONTRACTOR SHALL ADD GRASS SEED AND MULCH TO ALL UNPAVED/UNGRAVELED SURFACES THROUGHOUT THE SITE.
4. ALL SOIL STOCKPILES ARE TO HAVE WADDLE/FIBER ROLL PLACE AROUND THEM.

PERMANENT BMPs

GS	GRASS SEEDING
MU	MULCH
RR	RIP RAP
SS	4" OF 3" MINUS CRUSHED SANDSTONE

TEMPORARY BMPs

WD	10" DIA WADDLE/FIBER ROLL
CWO	CONCRETE WASHOUT
RD	ROCK CHECK DAM

NOTE:
STOCKPILING OF TOP SOIL: CONTRACTOR SHALL SEGREGATE AND STOCKPILE ALL TOPSOIL OUTSIDE OF THE CONSTRUCTION AREA WITH APPROPRIATE SEDIMENT CONTROL. TOP SOIL SHALL BE REDISTRIBUTED ON THE OUTSIDE OF CONSTRUCTED BERMS, AND EITHER SEEDED, AND MULCHED OR PROTECTED WITH EROSION CONTROL MEASURES. REFER TO CONSTRUCTION PLANS FOR DETAILS.

Rev #	Date	Description	By	Chkd

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ENDURING RESOURCES

SAN JUAN COUNTY, NM

ENDURING RESOURCES WLU 2309-24N WATER RECYCLE FACILITY SITE EROSION AND SEDIMENT CONTROL PLAN

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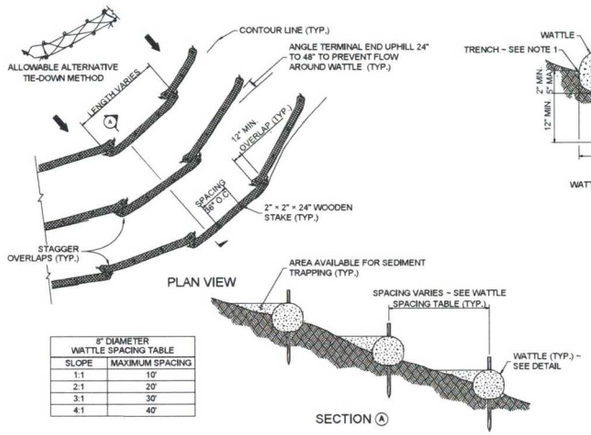
Date: September 2018
Scale: Horiz: Vert:
Project No: 9127383
Sheet: C111

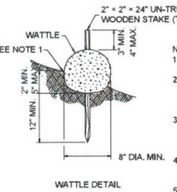
GENERAL NOTES

1. SEE SHEET C111 FOR SITE SPECIFIC APPLICATION OF EROSION CONTROL.
2. EROSION CONTROL SHALL BE IMPLEMENTED TO PROTECT PROPERTIES AND PUBLIC FACILITIES FROM THE ADVERSE EFFECTS OF EROSION AND SEDIMENTATION AS A RESULT OF CONSTRUCTION ACTIVITIES.
3. THE CONTRACTOR SHALL SET, LOCATE, AND MAINTAIN EROSION CONTROL MEASURES PER THE EROSION CONTROL PLAN, AND THE OWNER'S EXISTING ASSET STORMWATER POLLUTION PROTECTION PLAN. (SWPPP)
4. EROSION CONTROL MEASURES SHALL BE IMPLEMENTED AND SHALL BE KEPT IN PLACE UNTIL EROSION AND SEDIMENTATION POTENTIAL IS MITIGATED. REMOVAL OF SILT AND SEDIMENT IS REQUIRED PER SWPPP.
5. EROSION CONTROL DEVICES SHALL BE CHECKED AFTER EVERY STORM. REPAIRS OR REPLACEMENT TO THE EROSION CONTROL MEASURES SHALL BE MADE AS REQUIRED BY THE OWNERS PERMIT TO MAINTAIN PROPER PROTECTION.
6. SWPPP SHALL BE MODIFIED TO CONTROL EROSION AND SEDIMENT. TRANSPORT BY USING ANY MEANS SHOWN ON THIS PLAN OR IMPLEMENTING OTHER CONTROL MEASURES.
7. PERMANENT BEST MANAGEMENT PRACTICES (BMP'S) (I.E. SEEDED, MULCH) MUST BE IMPLEMENTED WITHIN 14 DAYS OF LAST CONSTRUCTION ACTIVITY IN THE AREA, AS REQUIRED PER THE SWPPP.
8. THE CONTRACTOR/OWNER SHALL UPDATE OR MODIFY THIS PLAN AS NEEDED TO COMPLY WITH THE APPLICABLE POLLUTANT DISCHARGE ELIMINATION SYSTEM REQUIREMENTS.
9. CONTRACTOR SHALL BE REQUIRED TO HAUL EXCESS CONCRETE AND WASHOUT OFF-SITE TO AN APPROVED/PERMITTED DISPOSAL SITE.
10. CONTRACTOR SHALL SPREAD STOCKPILED TOPSOIL BEFORE PLACING GRASS SEED AT CUT AND FILL LOCATIONS USING OWNER APPROVED MIX.
11. CONTRACTOR SHALL PLACE MULCH IN CONJUNCTION WITH GRASS SEEDING.



8" DIAMETER WATTLE SPACING TABLE	
SLOPE	MAXIMUM SPACING
1:1	10'
2:1	20'
3:1	30'
4:1	40'

WADDLE INSTALLATION ON SLOPES (WD)
N.T.S.



WATTLE DETAIL

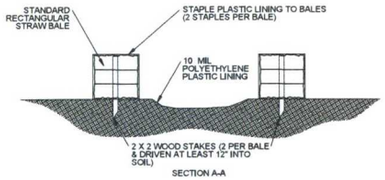
NOTES:
1. INSTALL WATTLES ALONG CONTOURS.
2. SECURELY KNOT EACH END OF WATTLE. OVERLAP ADJACENT WATTLE ENDS 12" BEHIND ONE ANOTHER AND SECURELY TIE TOGETHER.
3. COMPACT EXCAVATED SOIL AND TRENCHES TO PREVENT UNDERCUTTING. ADDITIONAL STAKING MAY BE NECESSARY TO PREVENT UNDERCUTTING.
4. INSTALL WATTLE PERPENDICULAR TO FLOW ALONG CONTOURS.
5. WATTLES SHALL BE INSPECTED REGULARLY, AND IMMEDIATELY AFTER A RAINFALL PRODUCES RUNOFF, TO ENSURE THEY REMAIN THOROUGHLY ENTRENCHED AND IN CONTACT WITH THE SOIL.

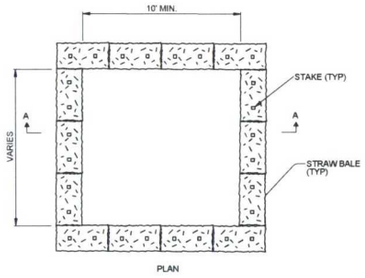
TEMPORARY BMPs

WD	10" DIA WADDLE/FIBER ROLL
CWO	CONCRETE WASHOUT
RD	ROCK CHECK DAM

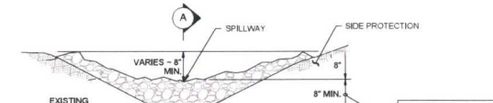
PERMANENT BMPs

GS	GRASS SEEDING
MU	MULCH
SS	4" OF 3" MINUS CRUSHED SANDSTONE

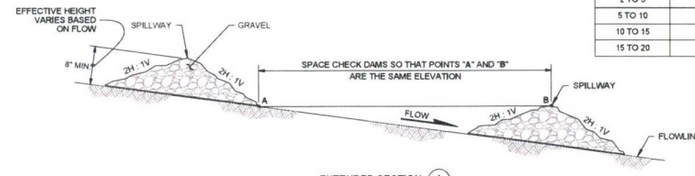




CONCRETE TRUCK WASH OUT FACILITY (CTW)
N.T.S.



ROCK CHECK DAM SPACING	
CHANNEL SLOPE (%)	SPACING (FEET)
< 2	100
2 TO 5	40
5 TO 10	20
10 TO 15	13
15 TO 20	10



EXTENDED SECTION (A)

ROCK CHECK DAM (RD)
N.T.S.

SOUDER, MILLER & ASSOCIATES
Engineering • Environmental • Surveying
Serving the Southwest & Rocky Mountains
8000 West Fourteenth Avenue
Lakewood, CO 80214
Phone (303) 239-9011 Toll-Free (877) 299-6932 Fax (303) 239-0745
www.soudermiller.com

Rev #	Date	Description	By	Check

SAN JUAN COUNTY, NM
ENDURING RESOURCES

ENDURING RESOURCES WLU 2309-24N WATER RECYCLE FACILITY
SITE EROSION AND SEDIMENTATION CONTROL DETAILS

THIS DRAWING IS INCOMPLETE AND NOT TO BE USED FOR CONSTRUCTION UNLESS IT IS STAMPED, SIGNED AND DATED

Designed	Drawn	Checked
HDM	GJF	HDM

Date: September 2018
Scale: Horiz: N/A Vert: N/A
Project No: 9127383
Sheet: C112

ATTACHMENT C - GEOMAT REPORT

GEOTECHNICAL ENGINEERING REPORT
WLU REMOTE FACILITY FRACKING WATER POND
SAN JUAN COUNTY, NEW MEXICO

Submitted To:

James McDaniel
Enduring Resources
332 CR 3100
Aztec, New Mexico 87410

Submitted By:

GEOMAT Inc.
915 Malta Avenue
Farmington, New Mexico 87401

July 6, 2018
GEOMAT Project 182-3038

GEOMAT INC.
915 Malta Avenue ◆ Farmington, NM 87401 ◆ Tel (505) 327-7928 ◆ Fax (505) 326-5721

July 6, 2018

James McDaniel
Enduring Resources
332 CR 3100
Aztec, New Mexico 87410

RE: Geotechnical Engineering Study
WLU Remote Facility Fracking Water Pond
San Juan County, New Mexico
GEOMAT Project No. 182-3038

GEOMAT Inc. (GEOMAT) has completed the geotechnical engineering exploration for the proposed WLU Remote Facility fracking water pond to be located in San Juan County, New Mexico. This study was performed in general accordance with the scope of services in our Proposal No. 182-04-22 dated April 20, 2018.

The results of our engineering study, including the geotechnical recommendations, site plan, boring records, and laboratory test results are attached. Based on the geotechnical engineering analyses, subsurface exploration and laboratory test results, the proposed pond could be constructed as an incised, double synthetic-lined pond as proposed. Other design and construction details, based upon geotechnical conditions, are presented in the report.

We have appreciated being of service to you in the geotechnical engineering phase of this project. If you have any questions concerning this report, please contact us.

Sincerely yours,
GEOMAT Inc.

Seth D. Yokel
Staff Geologist

Matthew J. Cramer, P.E.
Vice President

Copies to: Addressee (1) via E-mail

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Site Plan
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Unified Soil Classification
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Laboratory Test Results
Laboratory Test Procedures

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Important Information About This Geotechnical Engineering Report (Taken From GBA)

GEOTECHNICAL ENGINEERING REPORT
WLU REMOTE FACILITY FRACKING WATER POND
SAN JUAN COUNTY, NEW MEXICO
GEOMAT PROJECT NO. 182-3038

INTRODUCTION

This report contains the results of our geotechnical engineering exploration for the proposed WLU Remote Facility fracking water pond to be located in San Juan County, New Mexico, as depicted on the Vicinity Map and Site Plan in Appendix A of this report.

The purpose of these services is to provide information and geotechnical engineering recommendations about:

- subsurface soil conditions
- groundwater conditions
- lateral soil pressures
- earthwork
- slopes for pond walls
- drainage

The opinions and recommendations contained in this report are based upon the results of field and laboratory testing, engineering analyses, and experience with similar soil conditions, structures, and our understanding of the proposed project as stated below.

PROPOSED CONSTRUCTION

The WLU Remote Facility fracking water pond will have dimensions of approximately 350 feet by 350 feet and will be located at 36.210370° north latitude / 107.831582° west longitude. We understand the pond will be excavated (incised) into the existing grade at the site. The total depth of the pond will be 20 to 25 feet and it will be lined with a double HDPE liner system. The pond is located on relatively flat terrain.

SITE EXPLORATION

Our scope of services performed for this project included a site reconnaissance by a staff geologist, a subsurface exploration program, laboratory testing and engineering analyses.

Field Exploration:

Subsurface conditions at the site were explored on June 15, 2018, by drilling four exploratory borings, designated B-1 through B-4, at the approximate locations shown on the Site Plan in Appendix A. Borings B-2 through B-4 were drilled to depths of 35 feet below existing ground surface. Boring B-1 was terminated short of the planned depth of 35 feet due to auger refusal on sandstone at 30 feet below existing ground surface.

The borings were advanced using a CME-55 truck-mounted drill rig with continuous-flight, 7.25-inch O.D. hollow-stem auger. The borings were continuously monitored by a geologist from our office who examined and classified the subsurface materials encountered, obtained representative samples, observed groundwater conditions, and maintained a continuous log of each boring.

Soil samples were obtained from the borings using a combination of standard 2-inch O.D. split spoon and 3-inch O.D. modified California ring barrel samplers. The samplers were driven using a 140-pound hammer falling 30 inches. The standard penetration resistance was determined by recording the number of hammer blows required to advance the sampler in six-inch increments. Representative bulk samples of subsurface materials were also obtained.

Groundwater evaluations were made in each boring at the time of site exploration. Soils were classified in accordance with the Unified Soil Classification System described in Appendix A. Boring logs were prepared and are presented in Appendix A.

Laboratory Testing:

Samples retrieved during the field exploration were transported to our laboratory for further evaluation. At that time, the field descriptions were confirmed or modified as necessary, and laboratory tests were performed to evaluate the engineering properties of the subsurface materials.

SITE CONDITIONS

The site of the proposed pond is located roughly 300 feet east of an existing unnamed dirt road in a currently undeveloped area approximately 6 miles southwest of US Highway 550 by Nageezi, NM and Counselor, NM. The ground surface across the site of the proposed pond was generally flat with a gentle slope to the southwest. The area was vegetated by a significant growth of native weeds, sage brush, shrubs, and small trees at the time of our exploration. No evidence of prior structural development was noted at the site. The photo below depicts the site's condition at the time of our exploration.

Drill Rig at Boring B-2
View Toward the West

SUBSURFACE CONDITIONS

Soil Conditions:

As presented on the Boring Logs in Appendix A, in all four borings, B-1 through B-4, we encountered predominantly sandy soil conditions underlain by rock. Sandy soils were encountered in borings B-1 through B-4, to depths ranging from 2 to 6 feet below existing ground surface (bgs). Sandstone/Siltstone interlayered with shale lenses were encountered below the sandy soils in all the borings. The sandy soils were medium dense and were generally dry to damp. The sandstone/siltstone rock was generally slightly too moderately weathered.

Groundwater Conditions:

Groundwater was not encountered in any of the borings. Groundwater elevations can fluctuate over time depending upon precipitation, irrigation, runoff and infiltration of surface water. We do not have any information regarding the historical fluctuation of the groundwater level in this vicinity.

Laboratory Test Results:

Laboratory analyses of samples tested indicate the sandy and clayey soils have fines contents (silt- and/or clay-sized particles passing the U.S. No. 200 sieve) ranging from approximately 18 to 19 percent. Plasticity indices ranged from non-plastic to an index of 2. In-place dry densities of the soil and rock samples tested ranged from approximately 103 to 114 pounds per cubic foot (pcf), with natural moisture contents between approximately 3 and 12 percent.

Results of all laboratory tests are presented in Appendix B.

OPINIONS AND RECOMMENDATIONS

Geotechnical Considerations:

The site is considered suitable for the proposed fracking water pond based on the geotechnical conditions encountered and tested for this report and our understanding of the project. If there are any significant deviations from the assumed finished elevations and/or pond locations noted at the beginning of this report, the opinions and recommendations of this report should be reviewed and confirmed/modified as necessary to reflect the final planned design conditions.

Pond Design and Construction:

The fracking water pond could be constructed as an incised basin as proposed. The double HDPE liner system should be installed in accordance with the manufacturer's recommendations.

Our recommendations are based on the information obtained from the borings performed during our subsurface exploration. It should be realized that subsurface conditions could vary across the extent of the pond area, and these variations may not become apparent until construction is underway. If, during construction, soil types other than those encountered during our exploration are encountered, we should be contacted to observe the actual conditions and confirm/modify our recommendations, as appropriate.

Slope Stability Analysis:

A slope stability analysis was performed for the site to develop recommendations for the cut slope inclinations for the incised pond. Galena Slope Stability software (version 6.1) was used as an aid in developing our recommendations. Printouts of the software analyses are available upon request.

Based on the results of our subsurface exploration, laboratory testing, and engineering analyses, the maximum recommended inclinations for the pond walls are 2.5:1 in soils and 1:1 in rock.

We understand that no above-grade embankments are planned for the project. If the project scope changes to include embankments, GEOMAT should be notified to review the plans and confirm or modify our recommendations as necessary.

Seismic Considerations:

Based on the subsurface conditions encountered in the borings, we estimate that Site Class B is appropriate for the site according to Table 1613.5.2 of the 2009 International Building Code. This parameter was estimated based on extrapolation of data beyond the deepest depth explored, using methods allowed by the code. Actual shear wave velocity testing/analysis and/or exploration to a depth of 100 feet were not performed as part of our scope of services for this project.

Lateral Earth Pressures:

For soils above any free water surface, recommended equivalent fluid pressures for unrestrained foundation elements are presented in the following table:

- **Active:**
  - Granular soil backfill (on-site sand) .....35 psf/ft
  - Undisturbed subsoil .....30 psf/ft

- **Passive:**
  - Shallow foundation walls .....250 psf/ft
  - Shallow column footings.....350 psf/ft
  - Sump walls .....400 psf/ft

- **Coefficient of base friction**: 0.40
  The coefficient of base friction should be reduced to 0.30 when used in conjunction with passive pressure.

Where the design includes restrained elements, the following equivalent fluid pressures are recommended:

- **At rest:**
  Granular soil backfill (on-site sand) ..... 50 psf/ft
  Undisturbed subsoil ..... 60 psf/ft

Earthwork:

General Considerations:

The opinions contained in this report for the proposed construction are contingent upon compliance with recommendations presented in this section. Although underground facilities such as foundations, septic tanks, cesspools, basements and irrigation systems were not encountered during site reconnaissance, such features could exist and might be encountered during construction.

Site Clearing:

1. Strip and remove all existing fill, debris and other deleterious materials from the proposed construction areas.

2. If unexpected fills or underground facilities are encountered during site clearing, we should be contacted for further recommendations. All excavations should be observed by GEOMAT prior to backfill placement.

3. Stripped materials consisting of vegetation and organic materials should be removed from the site, or used to re-vegetate exposed slopes after completion of grading operations. If it is necessary to dispose of organic materials on-site, they should be placed in non-structural areas, and in fill sections not exceeding 5 feet in height.

4. Sloping areas steeper than 5:1 (horizontal:vertical) should be benched to reduce the potential for slippage between existing slopes and fills. Benches should be level and wide enough to accommodate compaction and earth moving equipment.

5. All exposed areas which will receive fill, once properly cleared and benched where necessary, should be scarified to a minimum depth of eight inches, conditioned to near optimum moisture content, and compacted to at least 95% of standard proctor (ASTM D698).

Excavation:

We present the following general comments regarding our opinion of the excavation conditions for the designers' information with the understanding that they are opinions based on our boring data. More accurate information regarding the excavation conditions should be evaluated by contractors or other interested parties from test excavations using the equipment that will be used during construction.

Based on our subsurface evaluation it appears that shallow excavations in soils at the site will be possible using standard excavation equipment, however, rock was encountered at relatively shallow depths across the site. Excavations that encounter formational rock are expected to be difficult and may necessitate the use of heavy-duty equipment and/or specialized techniques.

On-site soils may pump or become unstable or unworkable at high water contents. Dewatering may be necessary to achieve a stable excavation. Workability may be improved by scarifying and drying. Over-excavation of wet zones and replacement with granular materials may be necessary. Lightweight excavation equipment may be required to reduce subgrade pumping.

Fill Materials:

1. Native soils could be used in any areas cut for facilitation of the pond excavation.

2. Select granular materials should be used as backfill behind walls that retain earth.

3. On site or imported soils to be used in structural fills should conform to the following:

Gradation	**Percent finer by weight (ASTM C136)**
3"	100
No. 4 Sieve	50-100
No. 200 Sieve	50 Max
Maximum expansive potential (%)*	1.5

* Measured on a sample compacted to approximately 95 percent of the ASTM D698 maximum dry density at about 3 percent below optimum water content. The sample is confined under a 144-psf surcharge and submerged.

4. Aggregate base should conform to Type I Base Course as specified in Section 303 of the 2014 New Mexico Department of Transportation (NMDOT) *"Standard Specifications for Road and Bridge Construction."*

Placement and Compaction:

1. Place and compact fill in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift.

2. Un-compacted fill lifts should not exceed 10 inches loose thickness.

3. Materials should be compacted to the following:

Material	Minimum Percent (ASTM D698)
Liner Subgrade	Per Liner Manufacturer's Recommendations
Subgrade soils beneath fill areas	95
On site or imported soil fills:	
Beneath footings and slabs on grade	95
Aggregate base beneath slabs and pavements	95
Miscellaneous backfill	90

4. On-site and imported soils should be compacted at moisture contents near optimum.

Compliance:

To assess compliance, observation and testing should be performed by GEOMAT.

Drainage:

Surface Drainage:

Positive drainage should be provided during construction and maintained throughout the life of the proposed project to prevent surface runoff from entering the pond.

Protective slopes should be provided with a minimum grade of approximately 5 percent for at least 10 feet from the structures. Backfill against footings, exterior walls, and in utility trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration.

Subsurface Drainage:

Free-draining, granular soils containing less than five percent fines (by weight) passing a No. 200 sieve should be placed adjacent to walls which retain earth. A drainage system consisting of either weep holes or perforated drain lines (placed near the base of the wall) should be used to

intercept and discharge water which would tend to saturate the backfill. Where used, drain lines should be embedded in a uniformly graded filter material and provided with adequate clean-outs for periodic maintenance. An impervious soil should be used in the upper layer of backfill to reduce the potential for water infiltration.

GENERAL COMMENTS

It is recommended that GEOMAT be retained to provide a general review of final design plans and specifications in order to confirm that grading recommendations in this report have been interpreted and implemented. In the event that any changes of the proposed project are planned, the opinions and recommendations contained in this report should be reviewed and the report modified or supplemented as necessary.

GEOMAT should also be retained to provide services during excavation, grading, and construction phases of the work. Construction testing, including field and laboratory evaluation of fill, backfill, and compacted slopes should be performed to determine whether applicable project requirements have been met.

The analyses and recommendations in this report are based in part upon data obtained from the field exploration. The nature and extent of variations beyond the location of test borings may not become evident until construction. If variations then appear evident, it may be necessary to re-evaluate the recommendations of this report.

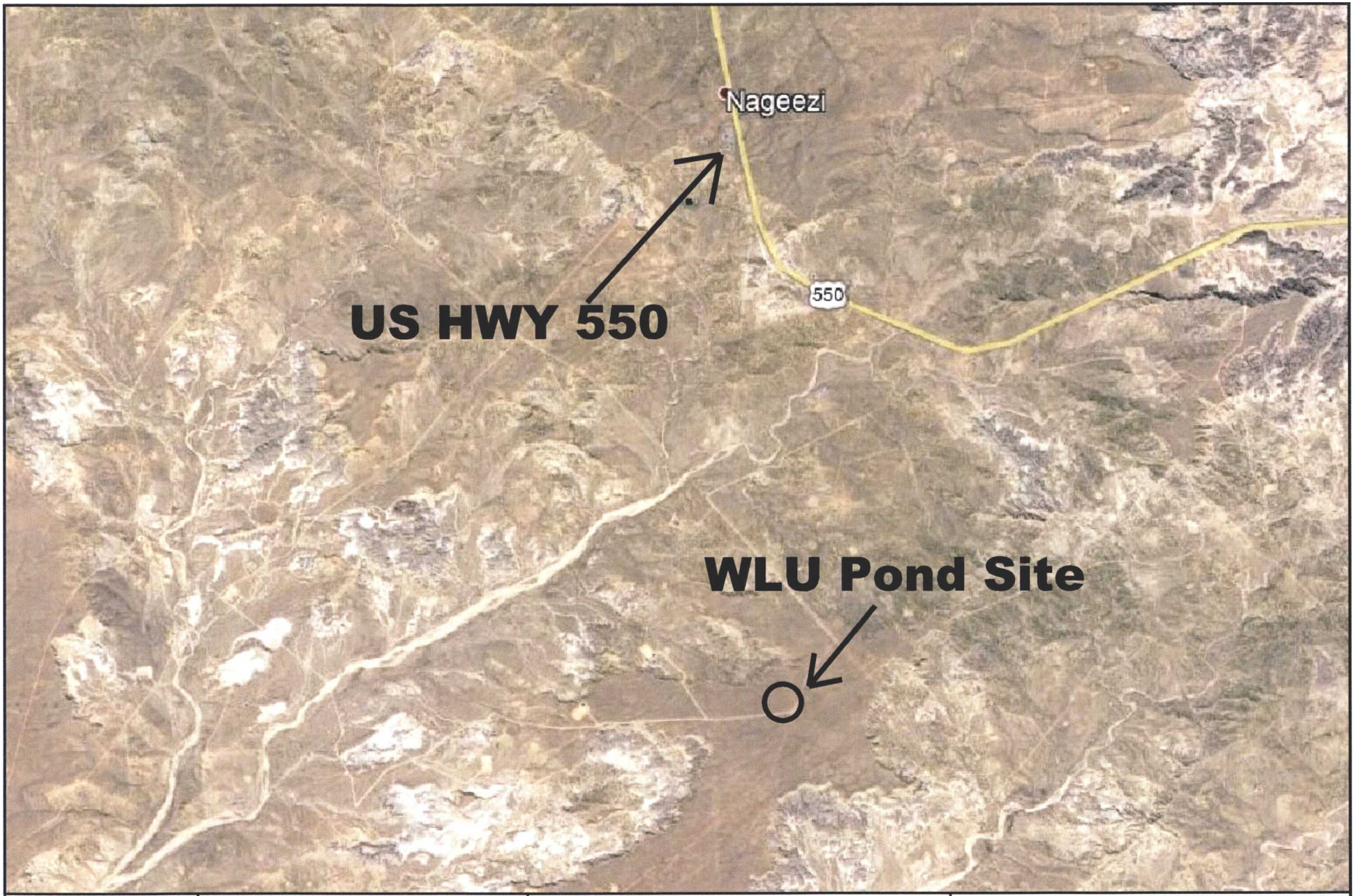
Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in this or similar localities at the same time. No warranty, express or implied, is intended or made. We prepared the report as an aid in design of the proposed project. This report is not a bidding document. Any contractor reviewing this report must draw his own conclusions regarding site conditions and specific construction equipment and techniques to be used on this project.

This report is for the exclusive purpose of providing geotechnical engineering and/or testing information and recommendations. The scope of services for this project does not include, either specifically or by implication, any environmental assessment of the site or identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such contamination, other studies should be undertaken. This report has also not addressed any geologic hazards that may exist on or near the site.

This report may be used only by the Client and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both on and off site), or other factors may change over time and additional work may be required with the passage of time. Any party,

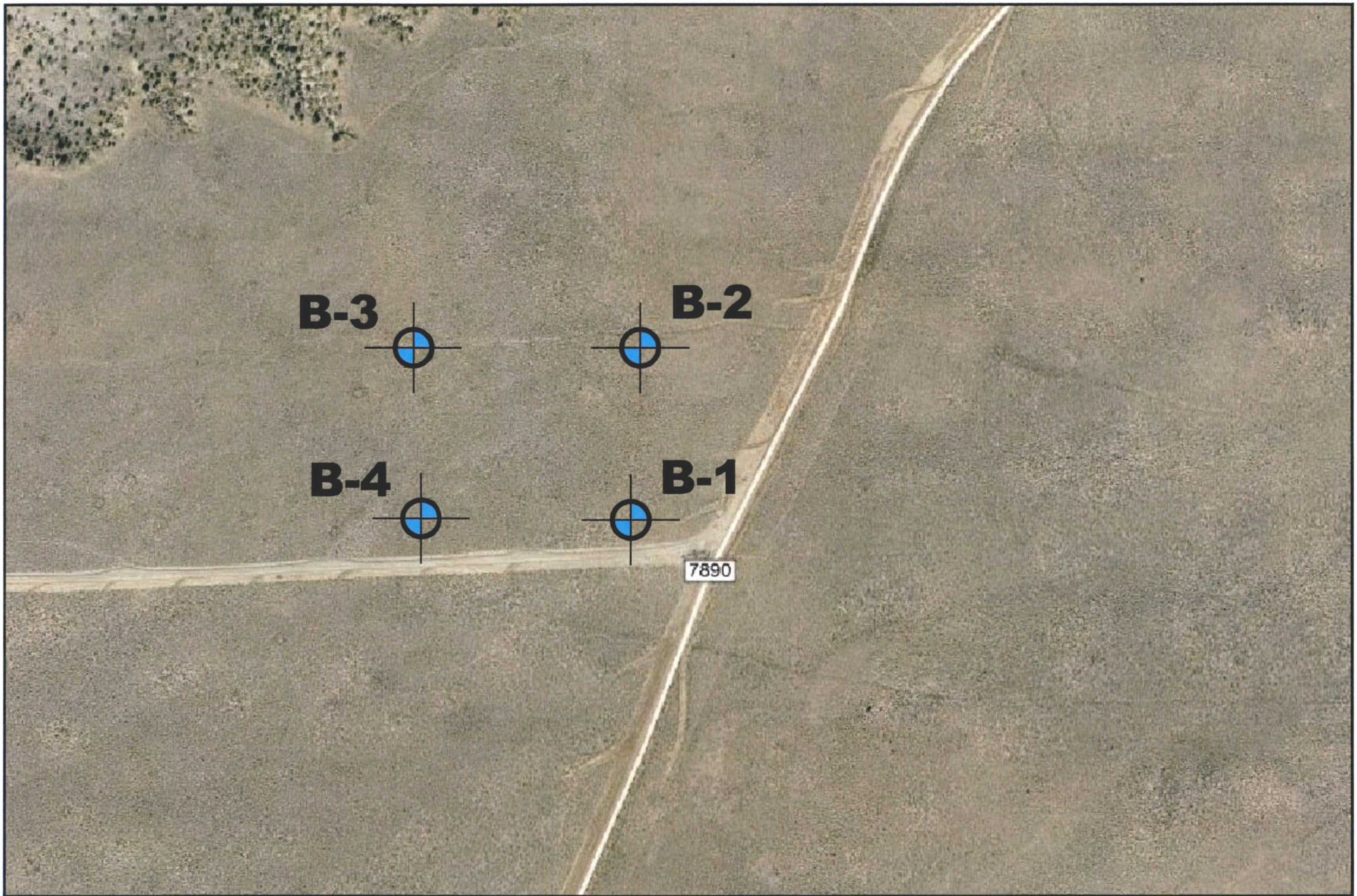
other than the Client, who wishes to use this report, shall notify GEOMAT in writing of such intended use. Based on the intended use of the report, GEOMAT may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements, by the Client or anyone else, will release GEOMAT from any liability resulting from the use of this report by an unauthorized party.

Appendix A



Approximate Not to Scale	VICINITY MAP Locations (approximate) GEOMAT Project No. 182-3038 Date of Exploration: June 15, 2018	PROJECT WLU Remote Facility Pond Enduring Resources San Juan County, New Mexico

GEOMAT INC.



Approximate Not to Scale	SITE PLAN Boring Locations (approximate) GEOMAT Project No. 182-3038 Date of Exploration: June 15, 2018	PROJECT WLU Remote Facility Pond Enduring Resources San Juan County, New Mexico

GEOMAT INC.

GEOMAT INC
915 Malta Avenue
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Borehole B-1

Project Name: WLU Remote Facility Pond
Project Number: 182-3038
Client: Enduring Resources
Site Location: San Juan County, New Mexico
Rig Type: CME-55
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: Ring and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 6/15/2018
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: SY
Remarks: SE Corner

Laboratory Results										
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Symbol	Material Type	Soil Symbol	Depth (ft)	Soil Description
	18	NP		7-13-16	SS 18		SM		1–4	Silty SAND, tan/orange, fine grained, medium dense, slightly damp to dry
110.6			12.0	13-19-21	R 18		SC		5–6	Clayey SAND, tan/orange, fine grained, medium dense, slightly damp, contains caliche
				25-31-50/5"	SS 17		RK		7–10	SILTSTONE, tan/gray, fine grained, weakly to moderately cemented Contains intermittent shale lenses (tan/gray with orange mottling)
				50/2"	R 2				11–17	Contains intermittent sandstone/shale lenses
				50/4"	SS 4		RK		18–23	SANDSTONE, gray/white with orange mottling, fine grained, moderately cemented, slightly weathered
				20-50/2"	SS 8				24–26	Well cemented, purple layer Contains intermittent shale lenses
				50/1"	R 1				27–30	Well cemented, purple layer, hard drilling
									31–40	Auger Refusal on well cemented sandstone Total Depth 30½ feet

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample

GEOMAT 182-3038.GPJ GEOMAT.GDT 7/6/18

GEOMAT INC.
915 Malta Avenue
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Borehole B-2

Project Name: WLU Remote Facility Pond
Project Number: 182-3038
Client: Enduring Resources
Site Location: San Juan County, New Mexico
Rig Type: CME-55
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: Ring and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 6/15/2018
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: SY
Remarks: NE Corner

Laboratory Results				Blows per 6"	Sample Type & Length (in)	Symbol	Material Type	Soil Symbol	Depth (ft)	Soil Description
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)							
114.3	19	2	10.5	19-29-41	R 18		SM		1-4	Silty SAND, tan/brown, fine grained, medium dense, slightly damp to dry
				50/6"	SS 6				5-8	SANDSTONE, tan/gray, fine- to medium grained, weakly to moderately cemented, slightly weathered Contains intermittent shale lenses
				50/3"	R 0				10-14	
				50/2"	R 0				15-19	
				14-23-27	SS 18		RK		20-24	Contains intermittent shale lenses (gray/green shale at base of sample)
				50/2"	R 0				25-29	
				50/4"	SS 4				30-34	
				50/2"	SS 2				35-40	Total Depth 35½ feet

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample

GEOMAT 182-3038.GPJ GEOMAT.GDT 7/6/18

GEOMAT INC
915 Malta Avenue
Farmington, NM 87401
Tel (505) 327-7928
Fax (505) 326-5721

Borehole B-3

Project Name: WLU Remote Facility Pond
Project Number: 182-3038
Client: Enduring Resources
Site Location: San Juan County, New Mexico
Rig Type: CME-55
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: Ring and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 6/15/2018
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: SY
Remarks: NW Corner

Laboratory Results										
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Symbol	Material Type	Soil Symbol	Depth (ft)	Soil Description
							SM		1	Silty SAND, tan/brown, fine grained, medium dense, slightly damp
				8-12-16	SS 18				2	
									3	
									4	SANDSTONE, tan/gray, fine- to medium grained, slightly damp, slightly weathered, weakly to moderately cemented
102.9			5.7	29-50/5"	R 11				5	
									6	
									7	
									8	
									9	
				28-50/5"	SS 11				10	
									11	
									12	
									13	
									14	
									15	
107.5			10.1	50/6"	R 6				16	Contains intermittent shale lenses
									17	
									18	
									19	
							RK		20	
				50/5"	SS 5				21	
									22	
									23	
									24	
									25	
				50/6"	R 6				26	Contains intermittent shale lenses
									27	
									28	
									29	
									30	
				50/6"	SS 6				31	
									32	
									33	
									34	
									35	
				50/5"	SS 5				36	Total Depth 35½ feet
									37	
									38	
									39	
									40	

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample

GEOMAT 182-3038.GPJ GEOMAT.GDT 7/6/18

GEOMAT INC.
915 Malta Avenue
Farmington, NM 87401
Tel (505) 327-7928
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Borehole B-4

Project Name: WLU Remote Facility Pond
Project Number: 182-3038
Client: Enduring Resources
Site Location: San Juan County, New Mexico
Rig Type: CME-55
Drilling Method: 7.25" O.D. Hollow Stem Auger
Sampling Method: Ring and Split spoon samples
Hammer Weight: 140 lbs
Hammer Fall: 30 inches

Date Drilled: 6/15/2018
Latitude: Not Determined
Longitude: Not Determined
Elevation: Not Determined
Boring Location: See Site Plan
Groundwater Depth: None Encountered
Logged By: SY
Remarks: SW Corner

Laboratory Results										
Dry Density (pcf)	% Passing #200 Sieve	Plasticity Index	Moisture Content (%)	Blows per 6"	Sample Type & Length (in)	Symbol	Material Type	Soil Symbol	Depth (ft)	Soil Description
							SM		1	Silty SAND, tan/orange, fine grained, slightly damp to dry
									2	
110.7			2.9	13-17-23	R 18				3	SANDSTONE, tan, fine- to medium grained, slightly damp, weakly cement, moderately weathered
									4	
				14-15-25	SS 18				5	
									6	
									7	
									8	
									9	
									10	
104.4			12.8	19-50/3"	R 9		RK		11	Contains intermittent shale lenses
									12	
									13	
									14	
									15	
				32-50/5"	SS 11				16	
									17	
									18	
									19	SHALE, gray with orange mottling, slightly damp, moderately weathered
							RK		20	
				50/5"	R 5				21	SANDSTONE, tan, fine- to medium grained, slightly damp, weakly to moderately cemented, moderately weathered
									22	
									23	
									24	
									25	
				50/4"	SS 4				26	Contains intermittent shale lenses
									27	
									28	
							RK		29	
									30	
				50/5"	SS 5				31	Contains intermittent shale lenses
									32	
									33	
									34	
									35	
				50/2"	SS 2				36	Total Depth 35½ feet
									37	
									38	
									39	
									40	

A = Auger Cuttings R = Ring-Lined Barrel Sampler SS = Split Spoon GRAB = Manual Grab Sample D = Disturbed Bulk Sample

GEOMAT 182-3038.GPJ GEOMAT.GDT 7/6/18

UNIFIED SOIL CLASSIFICATION SYSTEM					CONSISTENCY OR RELATIVE DENSITY CRITERIA
Major Divisions			Group Symbols	Typical Names	
Coarse-Grained Soils More than 50% retained on No. 4 sieve	**Gravels** 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Standard Penetration Test Density of Granular Soils
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines	Penetration Resistance, N (blows/ft.) / Relative Density
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures	0-4 Very Loose
			GC	Clayey gravels, gravel-sand-clay mixtures	5-10 Loose
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines	11-30 Medium Dense
			SP	Poorly graded sands and gravelly sands, little or no fines	31-50 Dense
		Sands with Fines	SM	Silty sands, sand-silt mixtures	>50 Very Dense
			SC	Clayey sands, sand-clay mixtures	Standard Penetration Test Density of Fine-Grained Soils
Fine-Grained Soils 50% or more passes No. 200 sieve	**Silts and Clays** Liquid Limit 50 or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	Penetration Resistance, N (blows/ft.) / Consistency / Unconfined Compressive Strength (Tons/ft2)
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	<2 Very Soft <0.25
			OL	Organic silts and organic silty clays of low plasticity	2-4 Soft 0.25-0.50
	Silts and Clays Liquid Limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous free sands or silts, elastic silts	4-8 Firm 0.50-1.00
			CH	Inorganic clays of high plasticity, fat clays	8-15 Stiff 1.00-2.00
			OH	Organic clays of medium to high plasticity	15-30 Very Stiff 2.00-4.00
Highly Organic Soils			PT	Peat, mucic & other highly organic soils	>30 Hard >4.0

U.S. Standard Sieve Sizes

>12"	12"	3"	3/4"	#4	#10	#40	#200
Boulders	Cobbles	Gravel			Sand		Silt or Clay
		coarse	fine	coarse	medium	fine	

MOISTURE CONDITIONS

Dry	Absence of moist, dusty, dry to the touch
Slightly Damp	Below optimum moisture content for compaction
Moist	Near optimum moisture content, will moisten the hand
Very Moist	Above optimum moisture content
Wet	Visible free water, below water table

MATERIAL QUANTITY

trace	0-5%
few	5-10%
little	10-25%
some	25-45%
mostly	50-100%

OTHER SYMBOLS

R Ring Sample
S SPT Sample
B Bulk Sample
▼ Ground Water

BASIC LOG FORMAT:

Group name, Group symbol, (grain size), color, moisture, consistency or relative density. Additional comments: odor, presence of roots, mica, gypsum, coarse particles, etc.

EXAMPLE:

SILTY SAND w/trace silt (SM-SP), Brown, loose to med. Dense, fine to medium grained, damp

UNIFIED SOIL CLASSIFICATION SYSTEM

TEST DRILLING EQUIPMENT & PROCEDURES

Description of Subsurface Exploration Methods

Drilling Equipment – Truck-mounted drill rigs powered with gasoline or diesel engines are used in advancing test borings. Drilling through soil or softer rock is performed with hollow-stem auger or continuous flight auger. Carbide insert teeth are normally used on bits to penetrate soft rock or very strongly cemented soils which require blasting or very heavy equipment for excavation. Where refusal is experienced in auger drilling, the holes are sometimes advanced with tricone gear bits and NX rods using water or air as a drilling fluid.

Sampling Procedures - Dynamically driven tube samples are usually obtained at selected intervals in the borings by the ASTM D1586 test procedure. In most cases, 2" outside diameter, 1 3/8" inside diameter, samplers are used to obtain the standard penetration resistance. "Undisturbed" samples of firmer soils are often obtained with 3" outside diameter samplers lined with 2.42" inside diameter brass rings. The driving energy is generally recorded as the number of blows of a 140-pound, 30-inch free fall drop hammer required to advance the samplers in 6-inch increments. These values are expressed in blows per foot on the boring logs. However, in stratified soils, driving resistance is sometimes recorded in 2- or 3-inch increments so that soil changes and the presence of scattered gravel or cemented layers can be readily detected and the realistic penetration values obtained for consideration in design. "Undisturbed" sampling of softer soils is sometimes performed with thin-walled Shelby tubes (ASTM D1587). Tube samples are labeled and placed in watertight containers to maintain field moisture contents for testing. When necessary for testing, larger bulk samples are taken from auger cuttings. Where samples of rock are required, they are obtained by NX diamond core drilling (ASTM D2113).

Boring Records - Drilling operations are directed by our field engineer or geologist who examines soil recovery and prepares boring logs. Soils are visually classified in accordance with the Unified Soil Classification System (ASTM D2487), with appropriate group symbols being shown on the logs.

Appendix B

LAB NO.	BORING NO.	SAMPLE DEPTH (ft)	ASTM D698		MOISTURE CONT. (%)	DENSITY		ATTERBERG LIMITS			SWELL (%)	CONSOL TEST	% PASS #200 SIEVE	CLASSIFICATION
			Density	Moisture		WET (pcf)	DRY (pcf)	LL	PL	PI				
6636	B-1	2.5	--	--	--	--	--	NLL	NPL	NP	--	--	18	Silty **SAND (SM)**
6637	B-1	5	--	--	12.0	123.9	110.6	--	--	--	--	--	--	Clayey **SAND (SC)/SILTSTONE**
6638	B-2	2.5	--	--	10.5	126.3	114.3	24	22	2	--	--	19	Silty **SAND (SM)/SANDSTONE**
6639	B-3	5	--	--	5.7	108.7	102.9	--	--	--	--	--	--	**SANDSTONE**
6640	B-3	15	--	--	10.1	118.3	107.5	--	--	--	--	--	--	**SANDSTONE**
6641	B-4	2.5	--	--	2.9	114.0	110.7	--	--	--	--	--	--	**SANDSTONE**
6642	B-4	10.0	--	--	12.8	117.7	104.4	--	--	--	--	--	--	**SANDSTONE**

GEOMAT INC.

SUMMARY OF SOIL TESTS

Project	WLU Remote Facility Pond
Job No.	182-3038
Location	San Juan County, NM
Date of Exploration	6/15/2018

LABORATORY TESTING PROCEDURES

Consolidation Tests: One-dimensional consolidation tests are performed using "Floating-ring" type consolidometers. The test samples are approximately 2.5 inches in diameter and 1.0 inch high and are usually obtained from test borings using the dynamically-driven ring samplers. Test procedures are generally as outlined in ASTM D2435. Loads are applied in several increments to the upper surface of the test specimen and the resulting deformations are recorded at selected time intervals for each increment. Samples are normally loaded in the in-situ moisture conditions to loads which approximate the stresses which will be experienced by the soils after the project is completed. Samples are usually then submerged to determine the effect of increased moisture contents on the soils. Each load increment is applied until compression/expansion of the sample is essentially complete (normally movements of less than 0.0003 inches/hour). Porous stones are placed on the top and bottom surfaces of the samples to facilitate introduction of the moisture.

Expansion Tests: Tests are performed on either undisturbed or recompacted samples to evaluate the expansive potential of the soils. The test samples are approximately 2.5 inches in diameter and 1.0 inch high. Recompacted samples are typically remolded to densities and moisture contents that will simulate field compaction conditions. Surcharge loads normally simulate those which will be experienced by the soils in the field. Surcharge loads are maintained until the expansion is essentially complete.

Atterberg Limits/Maximum Density/Optimum Moisture Tests: These tests are performed in accordance with the prescribed ASTM test procedures.

Appendix C

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be,* and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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