

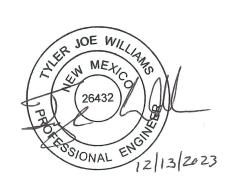
C-147 FLUID RECYCLING FACILITY
APPLICATION/REGISTRATION

**ANGELL RECYCLE FACILITY** 



Section 8, Township 17S, Range 33E Lea County, New Mexico

**DECEMBER 2023** 



PE #26432 Expires 12/31/2024 023249-00 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

Recycling Fa	<u>cility and/or Rec</u>	ycling Containment
Type of Facility:	Recycling Facility	☐ Recycling Containment*

**x** Registration

Type of action: X Permit

☐ 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.
e 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. or does approval relieve the operator of its responsibility to comply with any other applicable governmental authority's rules, regulations or ordinances.
Spur Energy Partners (For multiple operators attach page with information) OGRID #: 328947  Address: 9655 Katy Freeway, Suite 500, Houston TX 77024
Facility or well name (include API# if associated with a well): Angell Recycle North Pit
OCD Permit Number: 1RF-514 (For new facilities the permit number will be assigned by the district office)
U/L or Qtr/Qtr SE/4, NE/4 Section 8 Township 17 South Range 33 East County: Lea
Surface Owner: 🗌 Federal 🔲 State 🔀 Private 🔲 Tribal Trust or Indian Allotment
X   Recycling Facility:
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 32.894793° Longitude -103.680509° NAD83  For multiple or additional recycling containments, attach design and location information of each containment  Liner type: Thickness 60/40 mil LLDPE Thickness PVC Other  String-Reinforced  Liner Seams: Welded Factory Other Volume: 151,903 bbl Dimensions: L300 x W300 x D21  Recycling Containment Closure Completion Date:

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 \$ 2,997,579.27 (work on these facilities cannot commence until bonding amounts are approved)  Attach closure cost estimate and documentation on how the closure cost was calculated.		
Fencing:  Four foot height, four strands of barbed wire evenly spaced between one and four feet  X Alternate. Please specify 8-ft wire mesh game fence		
6.  Signs:  X 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 X No	
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 X 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 X 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 X No	

9. <u>Recycling Facility and/or Containment Checklist:</u> Instructions: Each of the following items must be attached to the application. India	cate, by a check i	nark in the box, that the documents are attached.
<ul> <li>☑ Design Plan - based upon the appropriate requirements.</li> <li>☑ Operating and Maintenance Plan - based upon the appropriate requirements.</li> <li>☑ Closure Plan - based upon the appropriate requirements.</li> <li>☑ Site Specific Groundwater Data -</li> <li>☑ Siting Criteria Compliance Demonstrations -</li> <li>☑ Certify that notice of the C-147 (only) has been sent to the surface owner(s)</li> </ul>		
10. Operator Application Certification:		
I hereby certify that the information and attachments submitted with this application a	re true, accurate	and complete to the best of my knowledge and belief.
Name (Print): SARAH CHAPMAN	Title:	REGULATORY DIRECTOR
Signature:	Date:	12/20/2023
e-mail address: SCHAPMAN@SPURENERGY.COM	Telephone:	832-930-8613

Title: \_\_\_ Environmental Specialist

OCD Permit Number: 1RF-514

X OCD Conditions
 Additional OCD Conditions on Attachment

District I
1625 N. French Dr., Hobbs, NM 88240
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Energy Minerals and Natural Resources
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Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-147 Revised April 3, 2017

### Recycling Facility and/or Recycling Containment Type of Facility: Recycling Facility Recycling Containment\*

\*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. Operator: Spur Energy Partners \_(For multiple operators attach page with information) OGRID #: 328947Address: 9655 Katy Freeway, Suite 500, Houston TX 77024 Facility or well name (include API# if associated with a well): Angell Recycle East Pit OCD Permit Number: 1RF-514 (For new facilities the permit number will be assigned by the district office) U/L or Otr/Otr NE/4, SE/4 Section 8 Township 17 South Range 33 East County: Lea Surface Owner: Federal State Private Tribal Trust or Indian Allotment **X** Recycling Facility: Location of recycling facility (if applicable): Latitude 32.849133° Longitude -103.676983° 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 ☐ Above ground tanks ☒ 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: 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  $32.848354^{\circ}$ Longitude -103.677789° NAD83 ☐ For multiple or additional recycling containments, attach design and location information of each containment  $\boxed{X}$  Lined  $\boxed{\Box}$  Liner type: Thickness 60/40 mil  $\boxed{\Box}$  LLDPE  $\boxed{X}$  HDPE  $\boxed{\Box}$  PVC  $\boxed{\Box}$  Other ☐ String-Reinforced

Liner Seams: Welded Factory Other Volume: 431,478 bbl Dimensions: L600 x W 400 x D21

Recycling Containment Closure Completion Date:

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 \$ 2,997,579.27 (work on these facilities cannot commence until bonding amounts are approved)  Attach closure cost estimate and documentation on how the closure cost was calculated.		
Fencing:  Four foot height, four strands of barbed wire evenly spaced between one and four feet  X Alternate. Please specify 8-ft wire mesh game fence		
Signs:  X 12"x 24", 2" lettering, providing Operator's name, site location, and emergency telephone numbers  Signed in compliance with 19.15.16.8 NMAC		
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.		
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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 X No	
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 X No	
Within 500 feet of a wetland.	Yes X No	

OCD Conditions

Additional OCD Conditions on Attachment

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.
<ul> <li>X Design Plan - based upon the appropriate requirements.</li> <li>X Operating and Maintenance Plan - based upon the appropriate requirements.</li> <li>X Closure Plan - based upon the appropriate requirements.</li> <li>X Site Specific Groundwater Data -</li> <li>X Siting Criteria Compliance Demonstrations −</li> <li>Certify that notice of the C-147 (only) has been sent to the surface ow</li> </ul>			
10. Operator Application Certification:			
I hereby certify that the information and attachments submitted with this applic	ation are true, accurate	e and complete to the best	of my knowledge and belief.
Name (Print): SARAH CHAPMAN	Title:	REGULATORY DIRE	CTOR
Signature:	Date:	12/20/2023	
e-mail address: SOFAPMAN@SPURENERGY.COM	Telephone:	832-930-8613	
11.			0.1.10.2.10.0.1
OCD Representative Signature: Victoria Venegas	· · · · · · · · · · · · · · · · · · ·	Approval Date:	01/03/2024
Title: _ Environmental Specialist	OCD Permit Nun	nber:1RF-514	

State of New Mexico <u>District I</u> 1625 N. French Dr., Hobbs, NM 88240 Energy Minerals and Natural Resources Department Oil Conservation Division

Form C-147 Revised April 3, 2017

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

District II

1220 South St. Francis Dr. Santa Fe, NM 87505

Recycling Facility and/or Recycling Containment		
Type of Facility: Recycling Facility  Type of action: Recycling Facility  Type of action: Recycling Facility  Type of action: Recycling Containment*  Registration  Extension  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. For does approval relieve the operator of its responsibility to comply with any other applicable governmental authority's rules, regulations or ordinances.		
Operator: Spur Energy Partners (For multiple operators attach page with information) OGRID #: 328947  Address: 9655 Katy Freeway, Suite 500, Houston TX 77024		
Facility or well name (include API# if associated with a well): Angell Recycle Middle Pit		
OCD Permit Number: 1RF-514 (For new facilities the permit number will be assigned by the district office)  U/L or Qtr/Qtr NE/4, SE/4 Section 8 Township 17 South Range 33 East County: Lea  Surface Owner: Federal State Private Tribal Trust or Indian Allotment		
Recycling Facility:   Location of recycling facility (if applicable): Latitude 32.849133°   Longitude -103.676983°   NAD83   Proposed Use: X Drilling* X Completion* X Production* 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   Above ground tanks X Recycling containment   Activity permitted under 19.15.17 NMAC explain type   Other explain   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:		
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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 32.848334°   Longitude -103.679171°   NAD83     For multiple or additional recycling containments, attach design and location information of each containment     X   Lined   Liner type: Thickness 60/40   mil   LLDPE   HDPE   PVC   Other     String-Reinforced		
Liner Seams: \( \text{Welded} \) \( \text{Factory} \) \( \text{Other} \) \( \text{Volume:} \) \( \text{431,478} \) \( \text{bbl} \) \( \text{Dimensions:} \( \text{L} \frac{600}{\text{ x W 400}} \) \( \text{x D21} \)		
Recycling Containment Closure Completion Date:		

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 \$ 2,997,579.27 (work on these facilities cannot commence until bonding amounts are approved)  Attach closure cost estimate and documentation on how the closure cost was calculated.		
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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 X No	
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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	
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Within 500 feet of a wetland.	Yes X No	

Title: Environmental Specialist

Additional OCD Conditions on Attachment

OCD Conditions

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10. Operator Application Certification:	
I hereby certify that the information and attachments submitted with this application ar	e true, accurate and complete to the best of my knowledge and belief.
Name (Print): SARAH CHAPMAN	Title: REGULATORY DIRECTOR
Signature: Service Cham	Date: 12/20/2023
e-mail address: SCHAPMAN@SPURENERGY.COM	Telephone: 832-930-8613
OCD Representative Signature: Victoria Venegas	Approval Date: 01/03/2024

OCD Permit Number: 1RF-514

Form C-147 Revised April 3, 2017

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State of New Mexico Energy Minerals and Natural Resources Department Oil Conservation Division 1220 South St. Francis Dr. Santa Fe NM 87505

Recycling Facility and/or Recycling Containment  Type of Facility: Recycling Facility Recycling Containment*  Type of action: Recycling Facility Recycling Containment*  Type of action: Recycling Facility Recycling Containment*  Type of action: Recycling Containment*  Type of action: Recycling Containment*  Type of action: Recycling Containment*  Type of Facility: Recycling Containment*  Type of action: Recycling Facility  Type of action: Recycling Containment*  Type of action: Recycling Facility  Type of action: Recycling Facili
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groundwater or surface water.    Strict   Fluid Storage   Above ground tanks   Recycling containment   Activity permitted under 19.15.17 NMAC explain type   Activity permitted under 19.15.36 NMAC explain type:   Other explain   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:   Closure Closure Completion Date:   Closure Closur
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Liner Seams: \( \overline{\text{W}}\) Welded \( \overline{\text{Factory}}\) Other \( \overline{\text{Volume:}}\) 431,478 bbl Dimensions: \( \overline{\text{L}}600 \) \( \overline{\text{W}}400 \) \( \overline{\text{L}}21 \)

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Within 500 feet of a wetland.	Yes X No	

9.  Recycling Facility and/or Containment Checklist:	
Instructions: Each of the following items must be attached to the application	on. Indicate, by a check mark in the box, that the documents are attached.
Tr.	
Design Plan - based upon the appropriate requirements.	
X Operating and Maintenance Plan - based upon the appropriate requirement	ents.
<ul> <li>X Closure Plan - based upon the appropriate requirements.</li> <li>X Site Specific Groundwater Data -</li> </ul>	
☐ Site Specific Groundwater Bata - ☐ ☐ Siting Criteria Compliance Demonstrations –	
Certify that notice of the C-147 (only) has been sent to the surface or	owner(s)
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	igation are true accurate and complete to the best of my knowledge and belief
I hereby certify that the information and attachments submitted with this appli	
Name (Print): SARAH CHAPMAN	Title: REGULATORY DIRECTOR
Signature:	Date: 12/20/2023
e-mail address: SCHAPMAN@SPURENERGY.COM	Telephone: 832-930-8613
OCD Representative Signature: Victoria Venegas	Approval Date: 01/03/2024
OCD Representative Signature	Approvai Date 1/00/2021
Title: Environmental Specialist	OCD Permit Number: 1RF-514
OCD Conditions	
Additional OCD Conditions on Attachment	<del></del>



December 13, 2023

Ms. Victoria Venegas New Mexico EMNRD Oil Conservation Division

RE: Rule 34 Variance Request - Produced Water Recycling Containment Secondary Liner

Ms. Venegas:

Spur Energy is requesting a variance to Rule 34 Part 12(A)(4) requiring secondary liners to be 30-mil string reinforced LLDPE. Spur is requesting approval to use 40-mil HDPE in place of the specified material in the proposed Recycle Containments. Based on our experience, we feel that the requested material will allow us to provide equal environmental protection in our impoundments.

Due to the construction of the 30-mil reinforced LLDPE material, nondestructive QA/QC testing cannot be performed. The proposed 40-mil HDPE and 40-mil LLDPE will be seamed in a manner that will allow nondestructive pressure testing of the seams to ensure proper sealing.

The proposed HDPE is appropriate material for the proposed use in the impoundment and is compatible with the material that will be stored. This material will provide equal or better environmental protection as the specified 30-mil reinforced LLDPE.

The proposed new liner system cross-section for the earthen containments is as follows: prepared subgrade, 10 oz. geotextile, 40-mil HDPE, 200-mil geonet, 60-mil HDPE. This will replace the crosssection required by the current rule. It should also be noted that this variance has been granted on past sites.

Should you have any questions or require additional information, please contact me by phone at 580-234-8780 or by email at twilliams@envirotechconsulting.com at your convenience.

Thank you for your consideration.

Best regards,

ENVIROTECH ENGINEERING & CONSULTING, INC.

Tyler Williams, P.E.

President and Principal Engineer

Tyt William

🗣 2500 N. Eleventh Street Enid, OK 73701 🏻 envirotechconsulting.com 🔀 info@envirotechconsulting.com 📞 580.234.8780

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December 13, 2023

Ms. Victoria Venegas New Mexico EMNRD Oil Conservation Division

Rule 34 Variance Request – Produced Water Impoundment Bird Netting RE:

Ms. Venegas:

Spur Energy is requesting a variance to Rule 34-Part 12(E) Netting to ensure the recycling facility is protected from wildlife. Based on our experience from previous projects, we believe audible bird deterrents provide equal or better protection when compared to netting. In addition, they require less inspection, maintenance, and repair over the life of the facility.

Spur is proposing to use the "Bird-X Mega Blaster Pro" system. This system will replace the netting required by the current rule. It should be noted that this variance has been granted on previous sites.

Should you have any questions or require additional information, please contact me by phone at 580-234-8780 or by email at twilliams@envirotechconsulting.com at your convenience.

Thank you for your consideration. Best regards,

ENVIROTECH ENGINEERING & CONSULTING, INC.

Tyler Williams, P.E.

President and Principal Engineer

Tyl William

ESS/ONAL



December 13, 2023

Ms. Victoria Venegas New Mexico EMNRD Oil Conservation Division

RE: Rule 34 Variance Request – Produced Water Impoundment Fencing

Ms. Venegas:

Spur Energy is requesting a variance to C-147 Fencing requirement for requiring a fence four foot in height, with four strands of barbed wire evenly spaced between one and four feet. Spur is requesting approval to a wire mesh game fence, eight (8) feet in height. Based on our experience, we feel that the requested fencing will provide greater security to the facility for excluding animals and unauthorized individual access. Details for this type of fence can be found on Sheet 12 of 12 in Appendix C Engineering Drawings.

The proposed fencing has been approved for other C-147 facilities and used extensively on similar projects in New Mexico and Texas with outstanding success in deterring unauthorized entry by both humans and wildlife. It should be noted that this variance request has been approved on previous sites.

Should you have any questions or require additional information, please contact me by phone at 580-234-8780 or by email at twilliams@envirotechconsulting.com at your convenience.

Thank you for your consideration. Best regards,

**ENVIROTECH ENGINEERING & CONSULTING, INC.** 

Tyler Williams, P.E.

President and Principal Engineer

Tyl William

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### **TABLE OF CONTENTS**

1.0	LOCATION		
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APPENDIX B **GEOTECHNICAL ENGINEERING REPORT** 

APPENDIX C **ENGINEERING DRAWINGS** 

APPENDIX D **DESIGN AND CONSTRUCTION PLAN** 

APPENDIX E **MATERIAL SPECIFICATION** 

**OPERATING AND MAINTENANCE PLAN** APPENDIX F

APPENDIX G **CLOSURE PLAN** 











i



### SITE CRITERIA FOR RECYCLING CONTAINMENT

### 1.0 LOCATION

Spur Energy Partners is proposing to construct a recycle facility, Angell Recycle Facility, located in Section 8, Township 17 South, Range 33 East in Lea County, New Mexico. An aerial photographic map, Figure 1, shows the location of the proposed facility. This study was performed on the proposed location to evaluate that the proposed facility location would be in accordance with the 19.15.34.11 NMAC Siting Requirements for Recycling Containments.

### 2.0 **DISTANCE TO GROUNDWATER**

### 2.1 **GROUNDWATER WELLS**

Banks Environmental Data (Banks) was contracted to search the New Mexico Office of State Engineers (OSE) records for water wells within a 1.0-mi. radius of the proposed facility location. According to Banks, thirteen (13) water wells were identified within a 1.0-mi radius of the proposed facility. No water wells were identified to be located within the proposed facility boundaries. The Banks Water Well Report is included as Appendix A, and Figure 2.1 illustrates the location of the thirteen (13) water wells located within a 1.0-mi. radius of the proposed facility.

Three (3) water wells are owned by the United States Geological Survey (USGS) and ten (10) water wells are listed within the New Mexico water well database.

The New Mexico Oil and Gas Division (NMOCD) requires that groundwater (freshwater as defined by NMOCD rules) at the location be greater than 50-ft below the containment bottom. Figure 2.1 demonstrates the following to meet these criteria:

- 1. The location of the proposed facility shown on the United States Geologic Survey (USGS) Dog Lake, NM 7.5 Minute Series Topographic Map.
- 2. A 1.0-mile radius from the site, and location of water wells in comparison to that radius. It should be noted, OSE wells can be mis-located as older wells are plotted in the center of the quarter, quarter, quarter section, township, and range.
- 3. The Banks search of the OSE records show there were no water wells located within the boundary of the proposed facility.

During onsite investigation, conducted by COZ Engineering, LLC on October 11, 2023, five (5) total borings were advanced on the proposed facility location. The five (5) borings were advanced to approximate depths of 3 to 65-ft. below ground surface (bgs.). The groundwater table was not encountered during the geotechnical investigation. The geotechnical engineering report prepared by COZ Engineering, LLC is included in Appendix B.

### 2.2 **AQUIFERS**

Information reviewed from the Bureau of Land Management (BLM) Carlsbad Field Office shows the proposed facility is located within the High Plains Aquifer system. The High Plains Aquifer consists of

1







Project No. 23.278-00

Figure 1

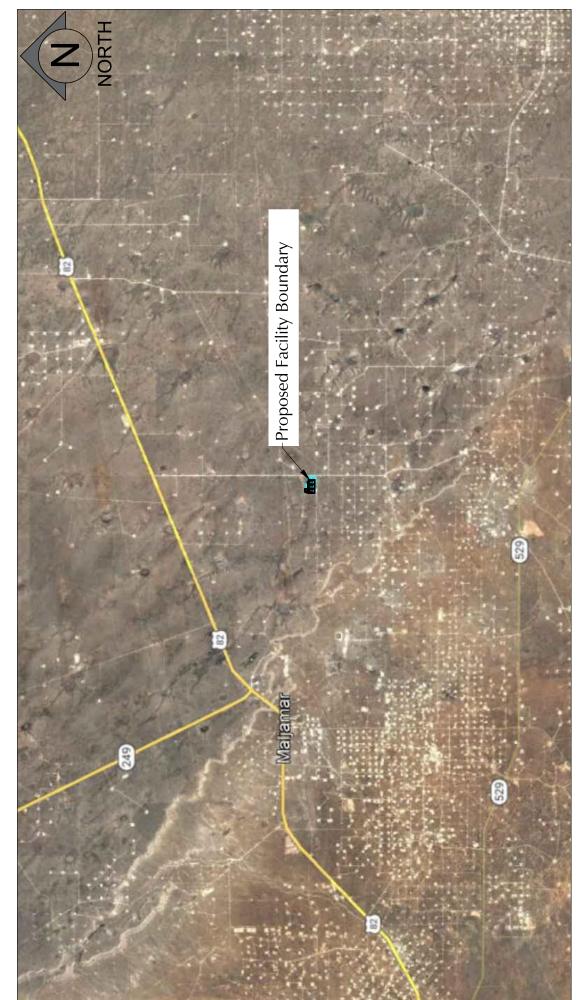




Site Map

Angell Recycle Facility
Section 8, Township 17 South, Range 33 East
Lea County, New Mexico



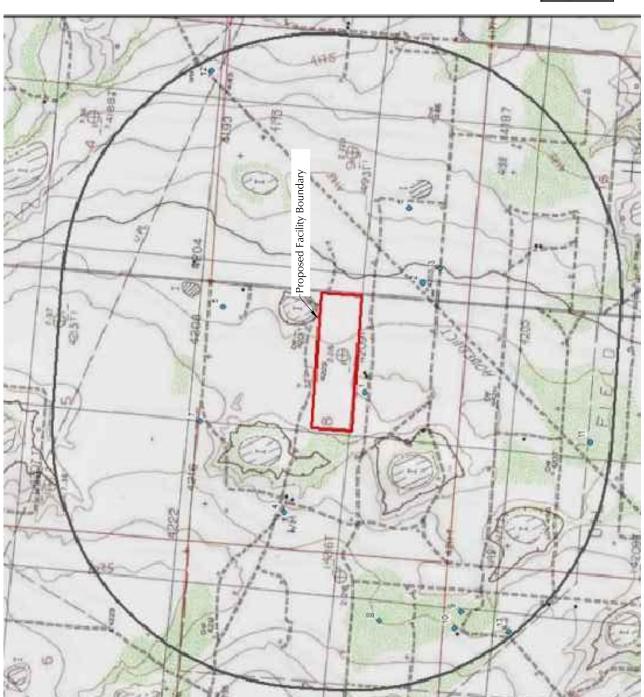


NORTH

Project No. 23.278-00 Project No. Figure 2.15







## Groundwater Wells Map

Angell Recycle Facility Section 8, Township 17 South, Range 33 East Lea County, New Mexico

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near-surface deposits of unconsolidated or partly consolidated gravel, sand, silt, or clay or Tertiary or Quaternary age. Depth to water in the aquifer is less than 50-ft. in parts of New Mexico but generally ranges from 50 to 400-ft. Figure 2.2 shows the site location in reference to Bureau of Land Management Declared Aquifers in the State of New Mexico.

### 2.3 **GEOLOGY**

A geological map of New Mexico was obtained from the United States Geological Survey (USGS) to review the geologic setting for the proposed containment location. Based on the review of the geologic map, the containment location lies within the Lower Pliocene to middle Miocene Ogallala Formation. The Ogallala Formation is composed of unconsolidated, coarse-detrital sands (alluvial and eolian) with some calcareous petrocalcic soils of the southern High Plains and marl.

Figure 2.3 is reproduction of the USGS New Mexico Geologic Map. Figure 2.3 shows the following:

- 1. Location of the proposed Containment
- 2. Geologic setting of the Containment

Area stratigraphy to a depth of 65-ft. bgs. was obtained from five (5) geotechnical borings conducted on the site by COZ Engineering, LLC on October 11, 2023. The boring logs showed the site conditions composed of exposed subgrade soils, limestone fragments and sparse to dense brush and grasses. Soils investigated at the site were composed of sand with varying amounts of clay, silt, gravel, and carbonate cementation from the surface to depths of 3 to 65-ft. bgs. The upper soils were underlain by very dense carbonate cemented soils or suspected limestone, causing auger refusal, to the total explored depths.

### 3.0 DISTANCE TO MUNICIPALITIES AND FRESHWATER FIELDS

Figure 3 demonstrates that the location is not located within incorporated municipal boundaries or within a defined municipal freshwater field covered under a municipal ordinance adopted pursuant to NMSA 1978, Section 3-27-3. Figure 3 illustrates the following:

- 1. The closest municipality to the proposed facility is Maljamar, New Mexico, located approximately 4.40-mi. to the west-northwest.
- 2. The closest freshwater field to the proposed facility is the Carlsbad Municipal Water System, located approximately 3.29-mi. to the northwest.

### 4.0 DISTANCE TO SUBSURFACE MINES

According to the New Mexico Mining and Minerals Division there are no subsurface mines near the proposed facility. The proposed facility location is not within an area overlying a subsurface mine. Figure 4 illustrates the following:

1. The nearest registered subsurface mine is the Intrepid North Compaction Plant, actively mining potash. The subsurface potash mine is located approximately 20.4-mi. to the southwest of the proposed facility location.

2





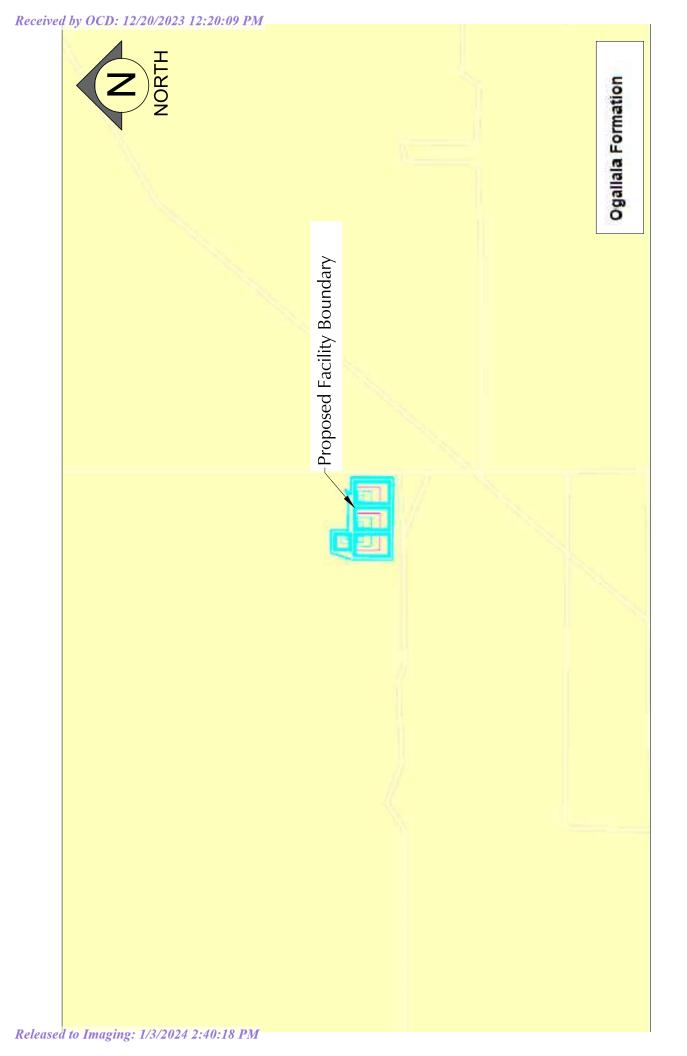


# New Mexico Aquifers Map

Angell Recycle Facility
Section 8, Township 17 South, Range 33 East
Lea County, New Mexico

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Proposed Facility Boundary Hummingbird Rd Hummingbird Rd Pecos River Basin Alluvial Roswell Basin System Rio Grande System Capitan Reef High Plains Other





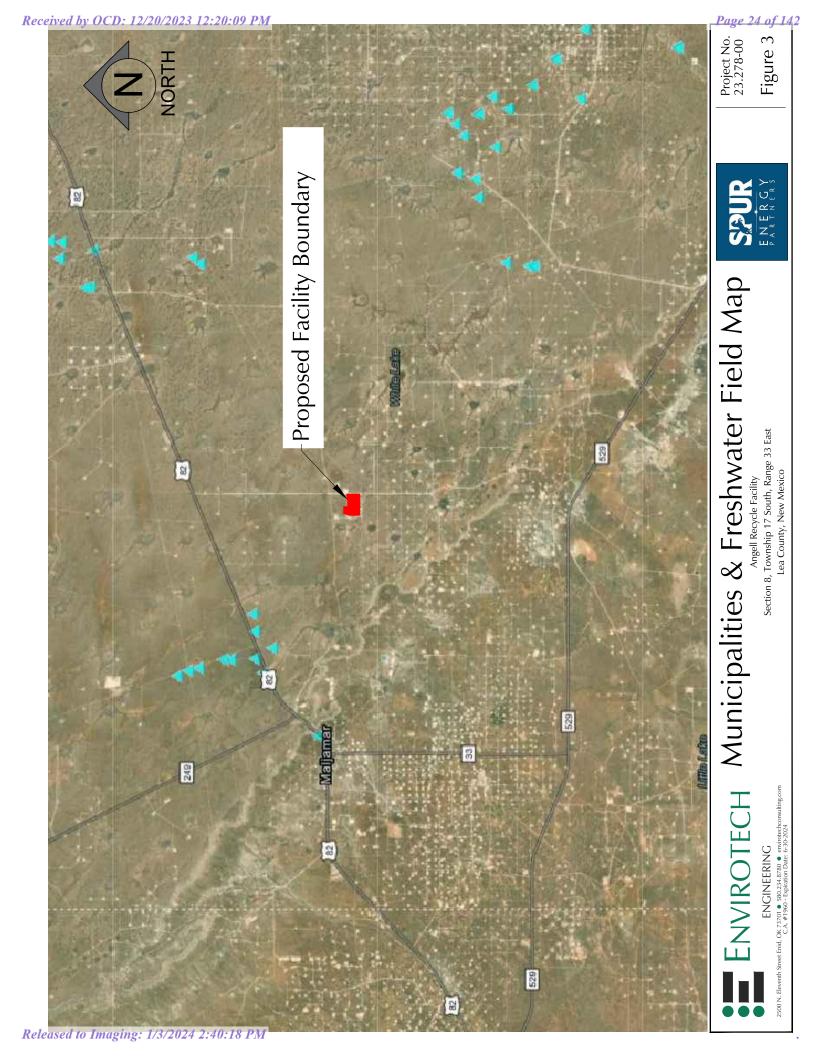
Angell Recycle Facility
Section 8, Township 17 South, Range 33 East
Lea County, New Mexico

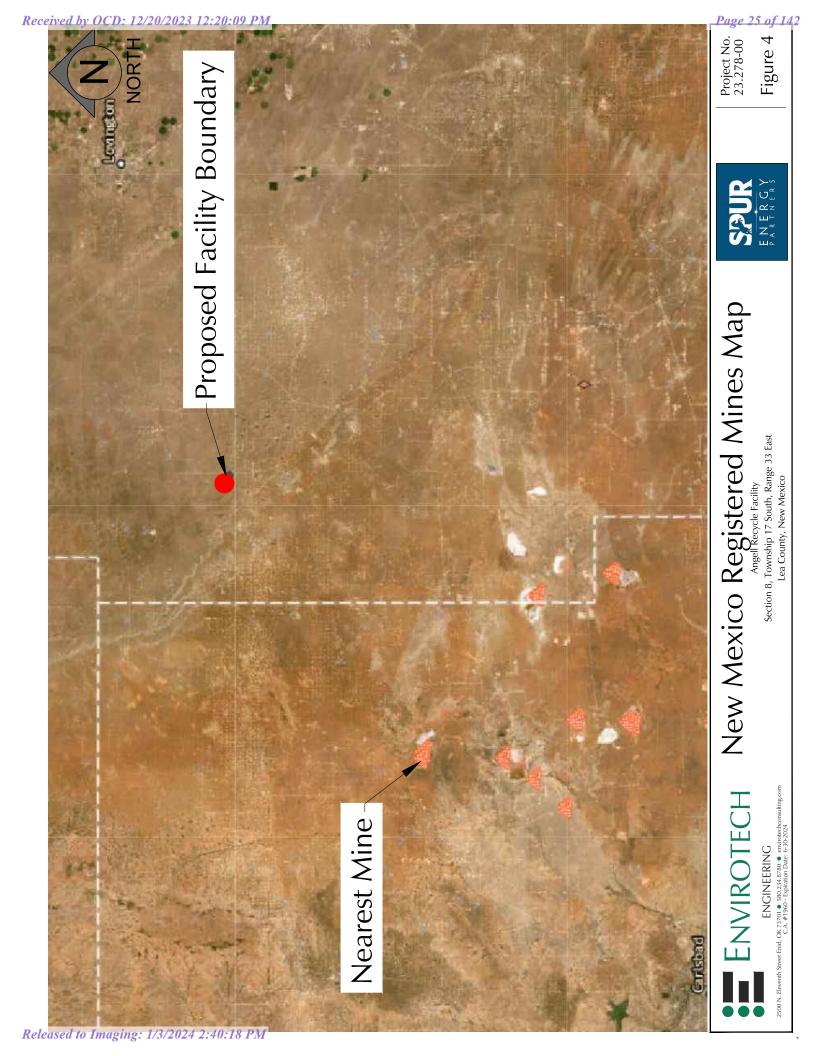




Project No. 23.278-00 Figure 2.3 278-00









### 5.0 DISTANCE TO HIGH OR CRITICAL KARST AREAS (UNSTABLE AREAS)

The Bureau of Land Management Carlsbad Field Office Cave Potential map was reviewed for the proposed facility. Figure 5 illustrates the following:

1. The proposed facility is located in a "low" karst potential area.

### 6.0 **DISTANCE TO 100-YEAR FLOOD PLAIN**

The Federal Emergency Management Agency (FEMA) Flood Map Service Center was utilized to review the flood map for the proposed facility location. The proposed facility is located on FEMA flood map panel number 35025C1075D, "Zone D" was effective on 12/16/2008. Figure 6 demonstrates the area of the site is not located within a 100-year Floodplain.

1. The proposed facility is located within "Zone D." Zone D for the proposed facility is an area of "area of undetermined flood hazard."

### **7.0 DISTANCE TO SURFACE WATER**

After review of the Dog Lake, NM, USGS 7.5-Minute Series Topographic map, Figure 7, there is no continuously flowing surface waters located on or near the proposed facility. Figure 7 illustrates the following:

- 1. No continuously flowing surface waters or other water bodies defined by NMOCD are located on the proposed facility.
- 2. The closest surface waterbody is an unnamed lake/pond structure located approximately 2.50mi. to the southeast.

### 8.0 DISTANCE TO PERMANENT RESIDENCE OR STRUCTURES

The United States Geological Survey (USGS) Dog Lake, NM, USGS 7.5-Minute Series Topographic Map, Figure 8, demonstrates:

- 1. The proposed facility is not within 1,000-ft. of an occupied permanent residence, school, hospital, institution, church, or other permanent structure.
- 2. Figure 8 and Figure 1 (Site Map) show that the nearest structure to the proposed facility is an oil tank battery located to the southwest.

### 9.0 DISTANCE TO NON-PUBLIC WATER SUPPLY

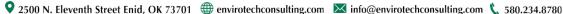
The proposed facility must not be within 500-ft. horizontally of a spring or freshwater well used for domestic or stock watering purposes, in existence at the time of initial application. Figure 9 demonstrates the following:

1. The proposed facility is not located within 500-ft. horizontally of a spring or freshwater well.

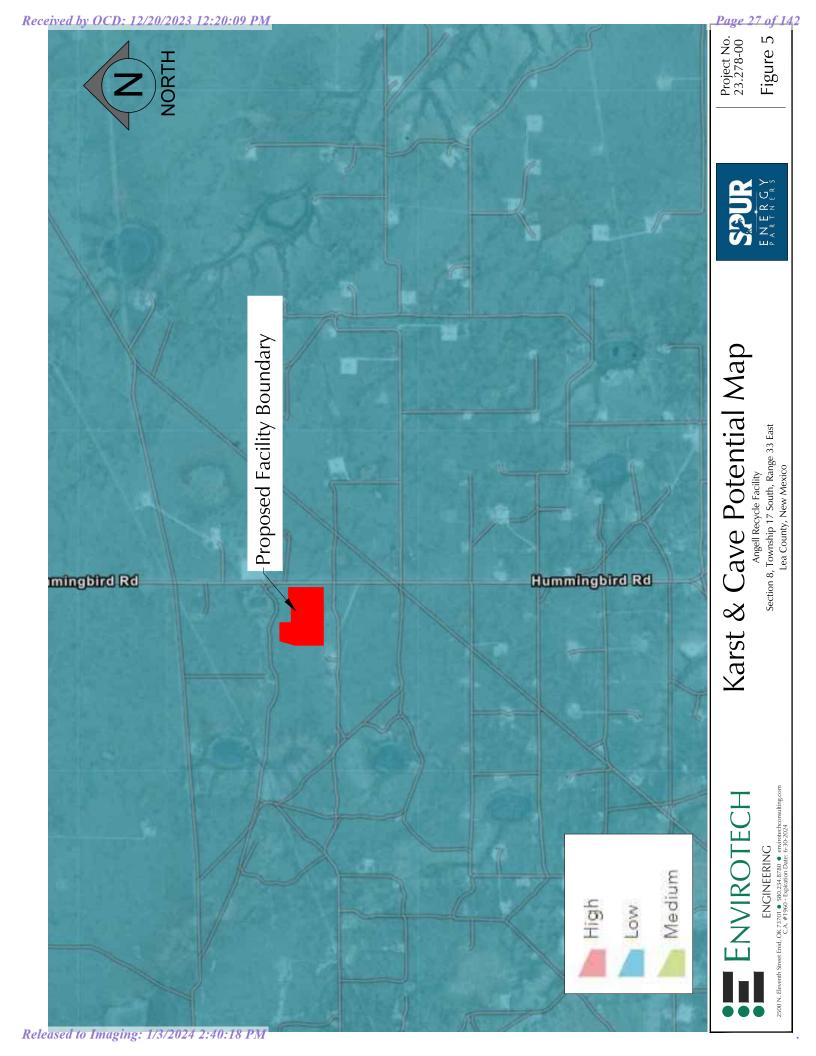
3

- 2. The nearest freshwater well or spring used for stock watering purposes is located approximately 1.03-ft. to the southwest of the proposed facility location.
- 3. No springs were identified within the proposed facility location.









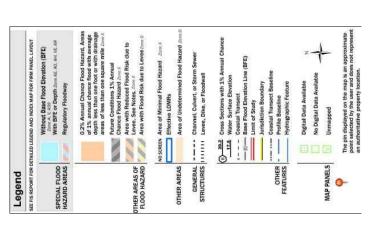
NORTH

Project No. 23.278-00

Figure 6



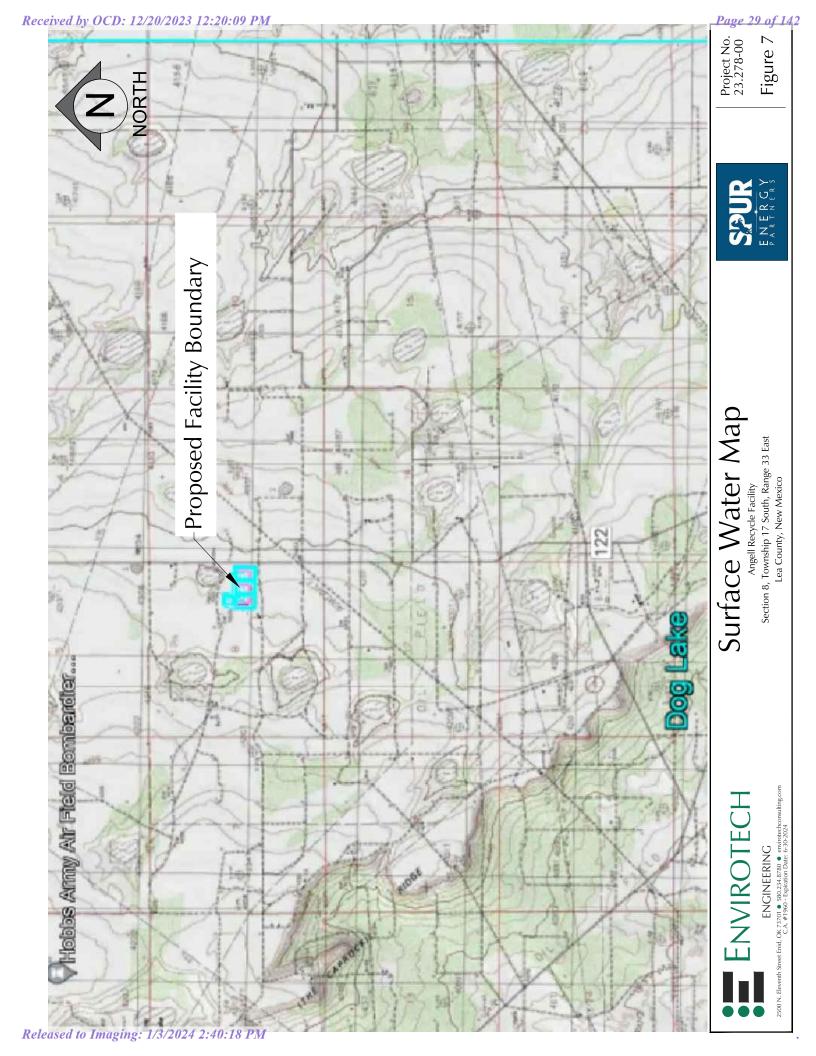


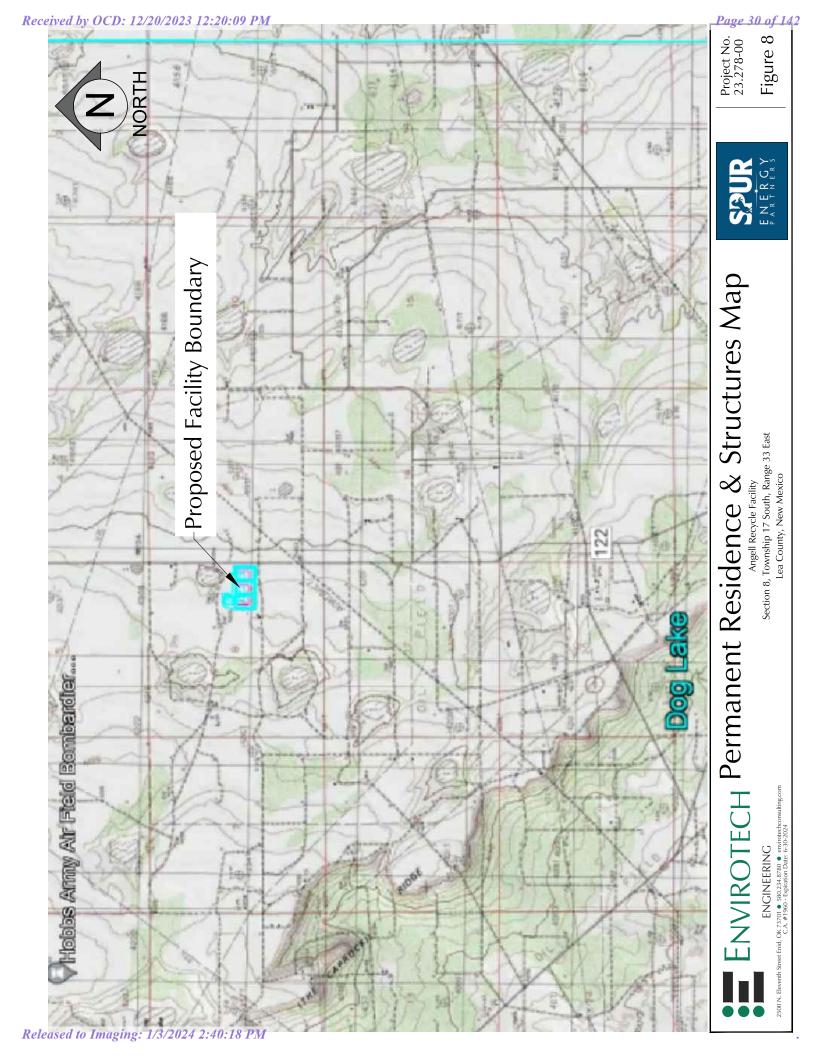


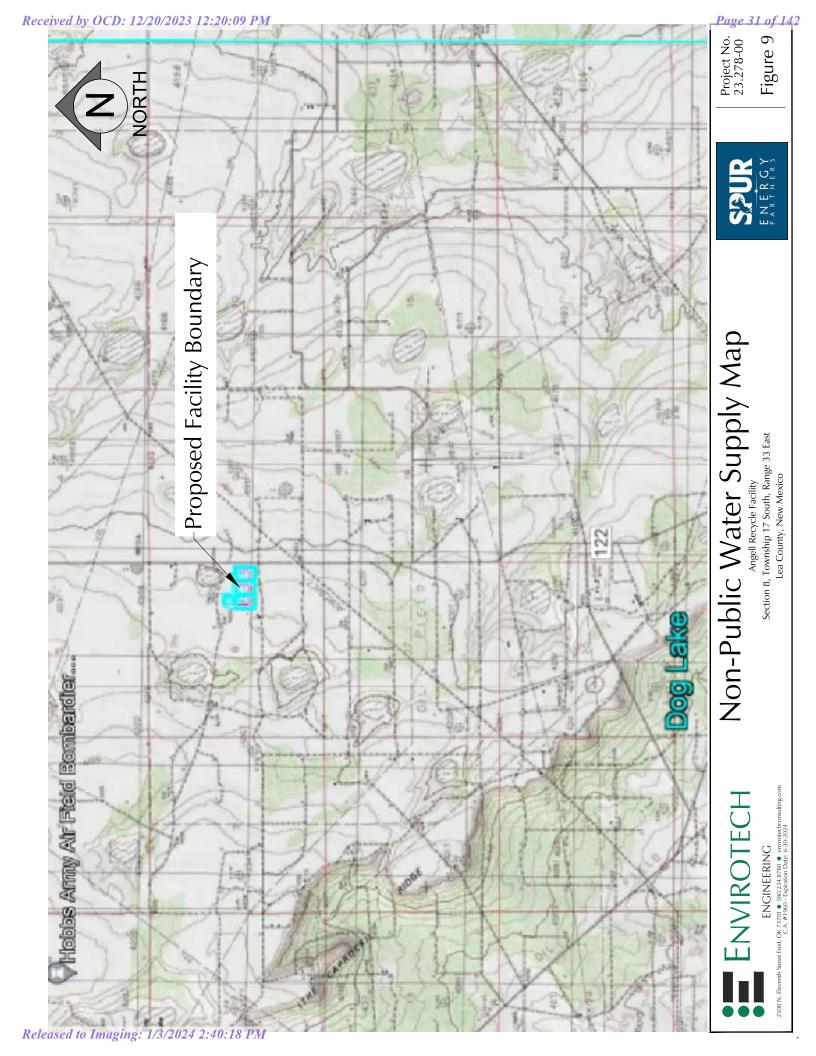


### FEMA Flood Map

Angell Recycle Facility
Section 8, Township 17 South, Range 33 East
Lea County, New Mexico









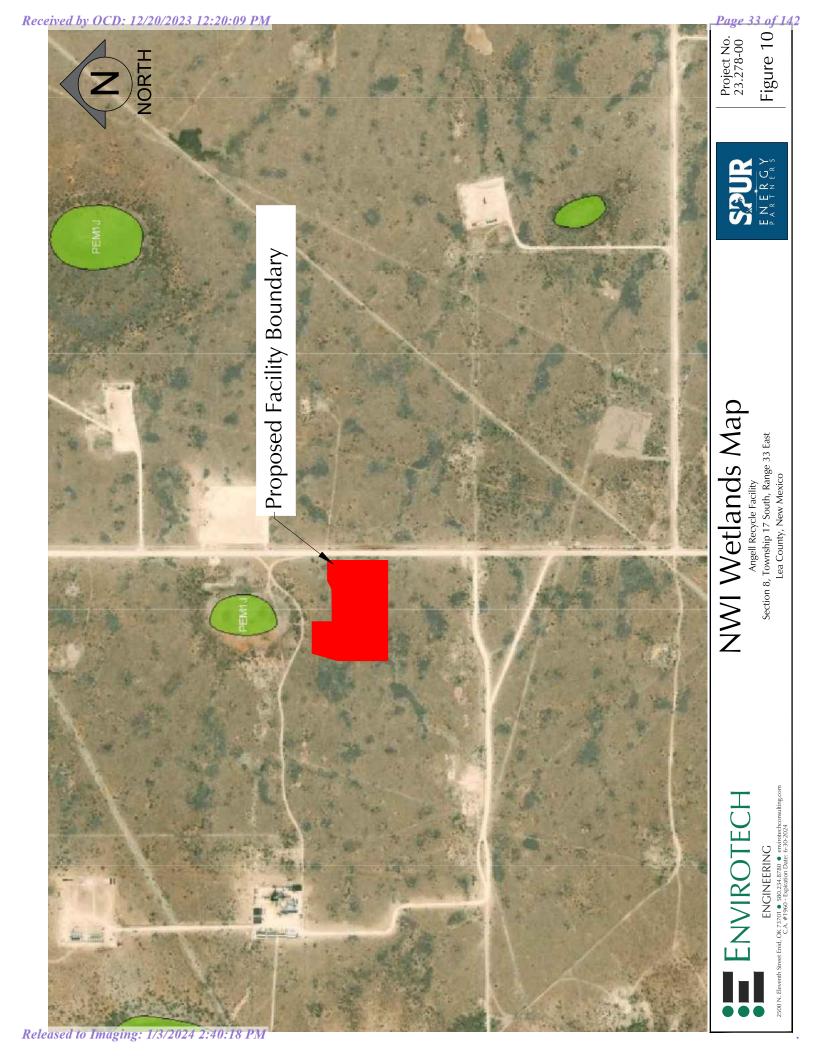
In addition, Figure 2.1 (Groundwater Wells Map) illustrates that the proposed facility location is not located within 1,000-ft. of known domestic water wells.

### 10.0 **DISTANCE TO WETLANDS**

The United States Fish and Wildlife National Wetlands Inventory Maps were reviewed for the area of the proposed facility. Figure 10 confirms the proposed facility is not located within an area of a potential wetland. In addition, Figure 10 illustrates the following:

- 1. The nearest potential wetland is located approximately 720-ft. to the northeast of the proposed facility location. The potential wetland closest to the proposed facility is labeled as a "freshwater emergent wetland" with a wetland code "PEM1J."
- The National Wetlands Inventory Maps do not show a potential wetland located within 500ft. of the proposed facility location.

It should be noted the United States Fish and Wildlife Service generates the NWI maps through infrared aerial imagery and aerial photograph interpretation; no actual field reconnaissance was conducted in the making of the maps. As such, the NWI maps do not always accurately identify wetlands or the extent of those wetlands; therefore, the maps are used for preliminary analysis only.





### **APPENDIX A**

### **BANKS WATER WELL REPORT**

Α

ENVIROTECH ENGINEERING and CONSULTING, INC PO Box 6029 Enid, OK 73702



### Water Well Angell Pit NM Report Lea County

PO #: 023249-00

ES-142999 Friday, October 27, 2023

### **Table of Contents**



Geographic Summary			
Maps			
Summary Map - 1 Mile Buffer	4		
Topographic Overlay Map - 1 Mile Buffer	5		
Current Imagery Overlay Map - 1 Mile Buffer	6		
Water Well Details			
Database Definitions and Sources			
Disclaimer			

# **Geographic Summary**



Location
Lea County, NM
Target location is 0.082 square miles and has a 1.36 mile perimeter

Coordinates	
Longitude & Latitude in Degrees Minutes Seconds	NA
Longitude & Latitude in Decimal Degrees	NA
X and Y in UTM	NA

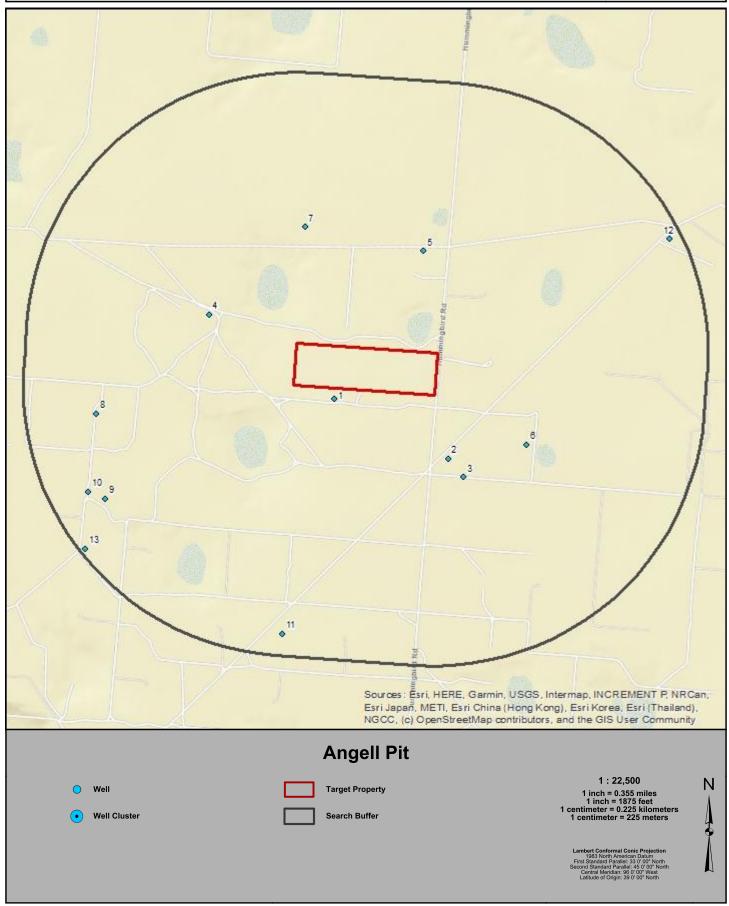
Elevation	
NA NA	

Zip Codes Searched	
Search Distance	Zip Codes (historical zip codes included)
Target Property	88264, 88260
1 mile	88264, 88260, 88260, 88213, 88262, 88264

Topos Searched		
Search Distance	Topo Name	
Target Property	Dog Lake (1985)	
1 mile	Dog Lake (1985)	

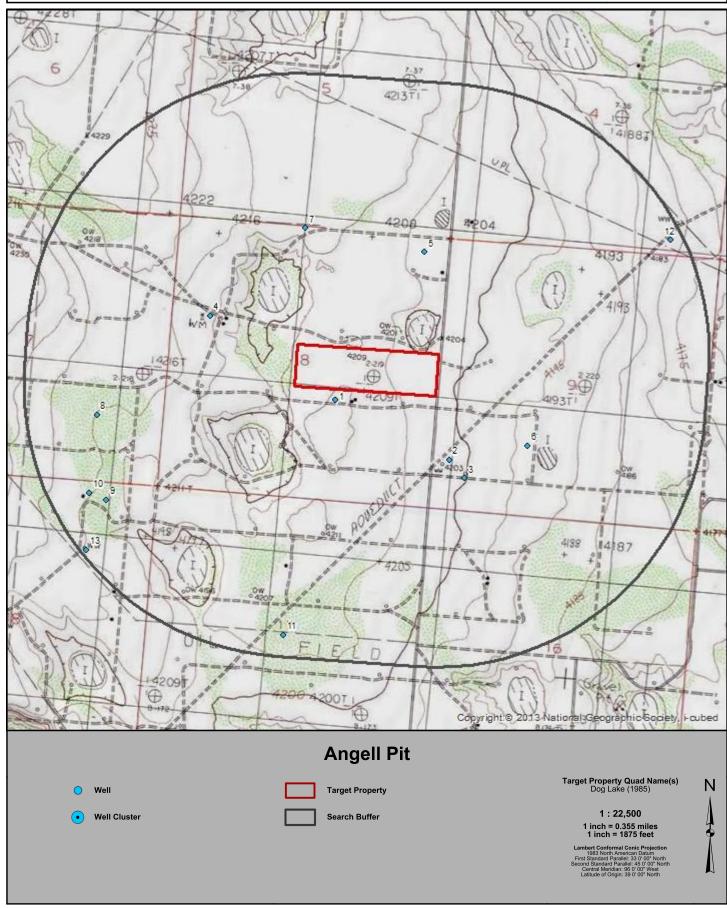
# **Summary Map - 1 Mile Buffer**





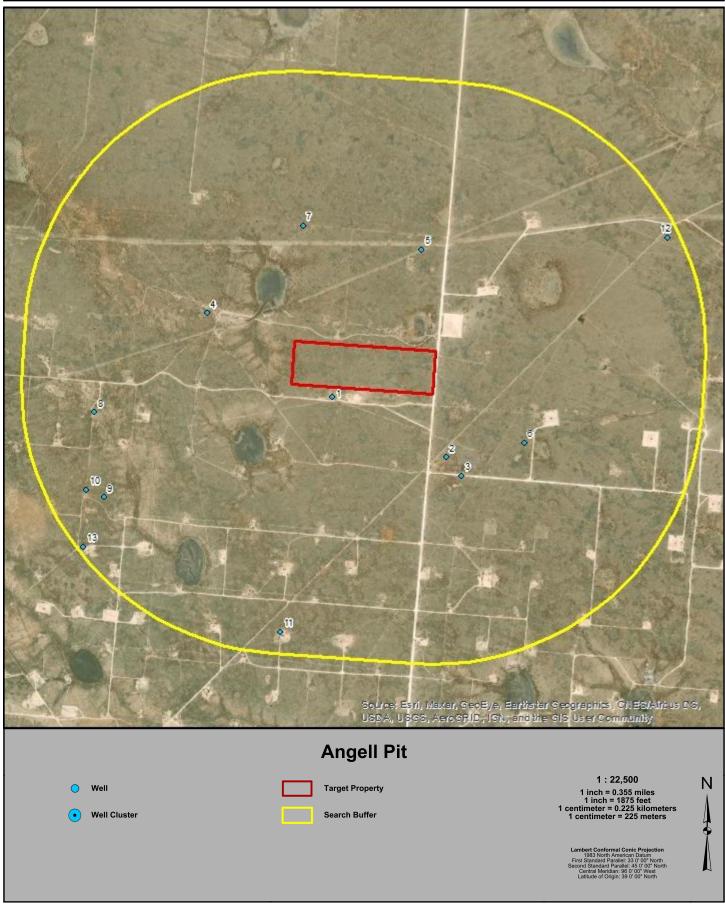
# **Topographic Overlay Map - 1 Mile Buffer**





# **Current Imagery Overlay Map - 1 Mile Buffer**





# **Water Well Details**



Map ID	Source ID	Dataset	Owner of Well	Type of Well	Depth Drilled	Completion Date	Longitude	Latitude	Elevation	Driller's Logs
1	L-04038	NM WW	HERSCHEL CAVINESS DBA CAVINESS CATTLE CO	72-12-1 PROSPECTI NG OR DEVELOPM ENT OF NATURAL RESOURCE	245	12/8/1958	-103.683209	32.847279	4213 ft	N/A
2	L-03528- S2	NM WW	WORKING INTEREST OWNERS MALJAMAR COOPERATIVE AGREEMENT	SECONDAR Y RECOVERY OF OIL	262	7/19/1967	-103.675673	32.844575	4204 ft	N/A
3	L-03749	NM WW	FRED POOL DRILLING COMPANY	72-12-1 PROSPECTI NG OR DEVELOPM ENT OF NATURAL RESOURCE	230	12/21/1957	-103.674607	32.84367	4203 ft	N/A
4	USGS3250 561034119 01	USGS WW	USGS	Not Reported	0	N/A	-103.6916	32.8512	4213 ft	N/A
5	L-01391- POD7	NM WW	ANGELL #2 FAMILY LTD PARTNRSHP	COMMERCI AL	280	6/30/2016	-103.678343	32.855561	4208 ft	N/A
6	USGS3250 361034000 01	USGS WW	USGS	Not Reported	230	N/A	-103.6708	32.8457	4195 ft	N/A
7	L-01391- POD8	NM WW	ANGELL #2 FAMILY LTD PARTNRSHP	COMMERCI AL	274	11/14/2017	-103.685995	32.85632	4212 ft	N/A
8	L-02770-S	NM WW	KEWANEE OIL COMPANY	MUNICIPAL - CITY OR COUNTY SUPPLIED WATER	227	7/13/1955	-103.698206	32.845397	4218 ft	N/A
9	L-03726	NM WW	MURPHY H BAXTER	DOMESTIC ONE HOUSEHOL D	208	11/30/1957	-103.69715	32.840895	4215 ft	N/A
10	USGS3250 221034140 01	USGS WW	USGS	Not Reported	208	N/A	-103.6983	32.8412	4217 ft	N/A
11	L-03622	NM WW	MURPHY H BAXTER	72-12-1 PROSPECTI NG OR DEVELOPM ENT OF NATURAL RESOURCE	226	7/25/1957	-103.685246	32.834483	4208 ft	N/A
12	L-03528	NM WW	WORKING INTEREST OWNERS MALJAMAR COOPERATIVE AGREEMENT	SECONDAR Y RECOVERY OF OIL	265	12/18/1957	-103.66282	32.857318	4182 ft	N/A
13	L-02770	NM WW	CONTINENTAL OIL CO.	MUNICIPAL - CITY OR COUNTY SUPPLIED WATER	216	6/28/1955	-103.698195	32.838136	4216 ft	N/A

# **Well Summary**

Water Well Dataset	# of Wells
NM WW	10
USGS WW	3
Total Count	13

# **Dataset Descriptions and Sources**



Dataset	Source	Dataset Description	Update Schedule	Data Requested	Data Obtained	Data Updated	Source Updated
NM WW - New Mexico Water Wells	New Mexico Office of the State Engineer	This WATERS dataset contains all groundwater records and water rights applications compiled by New Mexico Office of the State Engineer (OSE). OSE is in the process of digitizing all records, all wells have not yet been plotted.	Quarterly	10/19/2023	10/19/2023	10/19/2023	10/11/2023
NM WW HIST - New Mexico Historical Water Wells	New Mexico Office of the State Engineer	This dataset contains all groundwater records found at the New Mexico Office of the State Engineer Water Rights Division district office. Groundwater rights are administered and filed at the district level: Albuquerque (District I), Roswell (District II),		N/A	N/A	N/A	N/A
USGS WW - USGS Water Wells	U.S. Geological Survey	This dataset contains groundwater well records from the U.S. Geological Survey.	Semi- annually	04/05/2023	04/05/2023	04/05/2023	04/05/2023

### Disclaimer



The Banks Environmental Data Water Well Report was prepared from existing state water well databases and/or additional file data/records research conducted at the state agency and the U.S. Geological Survey. Banks Environmental Data has performed a thorough and diligent search of all groundwater well information provided and recorded. All mapped locations are based on information obtained from the source. Although Banks performs quality assurance and quality control on all research projects, we recognize that any inaccuracies of the records and mapped well locations could possibly be traced to the appropriate regulatory authority or the actual driller. It may be possible that some water well schedules and logs have never been submitted to the regulatory authority by the water driller and, thus, may explain the possible unaccountability of privately drilled wells. It is uncertain if the above listing provides 100% of the existing wells within the area of review. Therefore, Banks Environmental Data cannot fully guarantee the accuracy of the data or well location(s) of those maps and records maintained by the regulatory authorities.



**C147L REGISTRATION PACKAGE ANGELL RECYCLE FACILITY** SECTION 8, TOWNSHIP 17 SOUTH, RANGE 33 EAST LEA COUNTY, NEW MEXICO 023249-00

# APPENDIX B

# GEOTECHNICAL ENGINEERING REPORT

В

# COZ Engineering, LLC

### **GEOTECHNICAL ENGINEERING REPORT**

# ANGELL PIT RECYCLING FACILITY

Project No. 4223122 October 25, 2023

# Prepared for:

**ENVIROTECH ENGINEERING & CONSULTING, INC. Enid, Oklahoma** 

Prepared by:

COZ ENGINEERING, LLC Las Cruces, New Mexico

# **COZ Engineering, LLC**

PO Box 13331 Las Cruces, New Mexico 88013 Cell: 575.642.7671 Email: thecoz42@gmail.com

October 25, 2023

Envirotech Engineering & Consulting, Inc. 2500 North Eleventh Street Enid, OK 73701

Attn. Mitchell Ratke, EIT

P: 580.234.8780

E: <u>mratke@envirotechconsulting.com</u>

Re: Geotechnical Engineering Report

**Angell Pit Recycling Facility** 

32.849045, -103.678205, Hummingbird Lane

Lea County, New Mexico COZ Report No. 4223122

Dear Mr. Ratke:

The following is a geotechnical engineering report for the proposed Angell Pit Recycling Facility near Maljamar, New Mexico. Recommendations for earthwork, embankments and other geotechnical considerations are presented in the report.

Thank you for the opportunity to provide this geotechnical engineering report. If you have any questions or concerns, please contact me at (575)-642-7671.

Sincerely,

COZ Engineering, LLC

Dan Cosper, P.E.

Angell Pit Recycling Facility October 25, 2023 COZ Report No. 4223122

Site Investigation:	, and the second se
Site Conditions:	
Planned Construction:	
Site Grading:	2
Soil Improvements:	2
Fill Material:	į
Excavation of Embankment Areas:	į
Embankment Placement:	
Seismic Site Classification:	4
Testing and Inspection:	4
Report Limitations:	

# Appendix:

Site Plan **Boring Logs Laboratory Results**  Angell Pit Recycling Facility October 25, 2023

COZ Report No. 4223122

**Site Investigation:** 

A subsurface investigation was performed for the proposed Angell Pit Recycling Facility to

be located at Lat.: 32.849045° Long.: -103.678205° off Hummingbird Lane near Maljamar,

New Mexico. Five (5) test borings were advanced within the proposed facility near client

requested locations. The borings were advanced to depths of 3 to 65 feet below ground

surface (bgs) where auger refusal was encountered due to carbonate cemented soil or

suspected limestone bedrock.

Site Conditions:

The ground surface consisted of exposed subgrade soils, limestone fragments and sparse

to dense vegetation consisting of brush and grasses. Soils investigated at this site were

comprised of sand with varying amounts of clay, silt, gravel and carbonate cementation

from the surface to depths of 3 to 65 feet bgs. The upper soils were underlain by very

dense carbonate cemented soils or suspected limestone (ultimately causing auger refusal)

to the total explored depths.

The groundwater table was not encountered during the field investigation.

**Planned Construction:** 

Based on the information provided, the project will include the construction of a recycling

facility.

Angell Pit Recycling Facility

October 25, 2023

COZ Report No. 4223122

Site Grading:

Areas for planned construction should be clear of debris, vegetation and any oversized or

deleterious material prior to grading operations. Fill construction shall not be allowed on

surfaces that contain vegetation or rocks larger than four inches in greatest dimension

(with the exception of bedrock). No fill shall be placed that contains vegetative material as

decomposition of that material can cause voids and possibly result in surface settlement.

Voids in the soil matrix created or encountered during grading operations shall be

backfilled with compacted fill material.

Positive drainage away from embankments should be provided throughout the life of the

project. Areas adjacent to embankments that could retain water should be sealed or

eliminated.

Soil Improvements:

Subgrade preparation (beneath embankments and engineered fills) should consist of

scarifying the native soil surface a minimum thickness of 10 inches, moisture conditioning

(+/- 2% of optimum moisture content per ASTM D-698) and compaction to a minimum of

95% of standard Proctor density (per ASTM D-698). The subgrade preparation

recommendation does not apply to very dense cemented soils or bedrock surfaces when

exposed during construction. Engineered fill materials should be placed in 10-inch

maximum lifts, moisture conditioned to within 2% of optimum moisture content (per

ASTM D-698) and compacted to a minimum of 95% of standard Proctor density (per ASTM

D-698).

Angell Pit Recycling Facility October 25, 2023

COZ Report No. 4223122

## Fill Material:

Engineered fill material for this project should meet the following gradation criteria:

Sieve% Passing4"1003/470-100#450-100#20050 max.

The plasticity index of the minus #40 sieve portion should not exceed twenty (20). The upper on-site soils tested meet the above specifications.

# **Excavation of Embankment Areas:**

Difficult excavations due to very dense cemented soils or limestone will require particular attention in the design and construction.

The soils below the new embankments should be scarified ten inches, moisture conditioned and compacted (does not apply to very dense cemented soils or bedrock). The interior/exterior width of subgrade preparation should extend to the intersection of the slopes of the embankment fill. Once the subgrade preparation has been observed and approved by the geotechnical engineer, embankment fill operations can initiate.

### **Embankment Placement:**

Once the subgrade has been prepared, on-site embankment material stockpiles should be moisture conditioned in preparation for lift placement. The embankments should be constructed as a unit from the bottom elevation to the rim elevation.

Angell Pit Recycling Facility

October 25, 2023

COZ Report No. 4223122

The distal slopes of the embankments should be overbuilt and cut to final grade to provide

compaction to these edges of the embankments. The embankments should be constructed

in strict accordance with the project plans and specifications.

**Seismic Site Classification:** 

The seismic site classification is based upon the soil profile in the upper 100 feet as defined

by the weighted average of standard penetration blow-counts or shear wave velocity in

accordance with Section 20.4 of the ASCE 7 and the International Building Code (IBC).

Based upon my field investigation, it is my opinion that the Seismic Site Classification is C

("Very Dense Soil or Soft Rock"). The maximum depth of the borings advanced at the site

was 65 feet. Therefore, soil properties below the maximum boring depth to 100 feet were

estimated based on my experience with the general area. Deeper borings or geophysical

testing would be required to confirm the conditions below the current boring depth.

**Testing and Inspection:** 

It is recommended that all site grading operations be inspected by a geotechnical engineer.

The inspecting engineer should be responsible for immediately reporting any site or soil

conditions that vary significantly from this report.

The testing of materials should be made at the following:

1) One (1) soil density every 5,000 square feet of prepared subgrade and embankment

fill areas (ASTM D-1556, ASTM D-2167, or ASTM D-2922, ASTM D-3017).

Angell Pit Recycling Facility October 25, 2023

COZ Report No. 4223122

2) One (1) sieve analysis and plasticity index per material used according to

ASTM D-422 and ASTM D-4318.

3) One (1) proctor per each type of material used according to ASTM D-698.

**Report Limitations:** 

The conclusions, recommendations and opinions presented herein are:

1) Based upon evaluation and interpretation of the findings of the field and laboratory

program.

2) Based upon an interpolation of soil conditions between and beyond the explorations.

3) Subject to confirmation of the conditions encountered during construction.

4) Based upon the assumption that sufficient observation and testing will be provided

during construction.

There is no other warranty, either express or implied. Any person using this report for

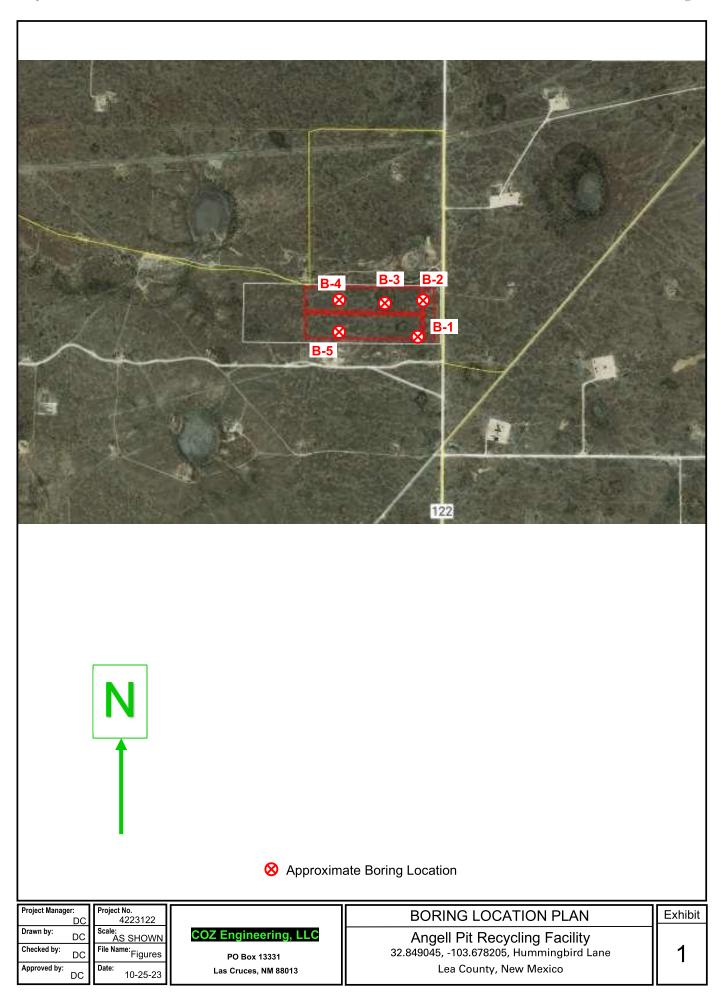
bidding or construction purposes should perform such independent investigation as he

deems necessary to satisfy himself as to the surface and subsurface conditions to be

encountered and the procedures to be used in the performance of work on this project. If

conditions are encountered during construction that appear to differ from those indicated

in this report, I should be notified immediately.

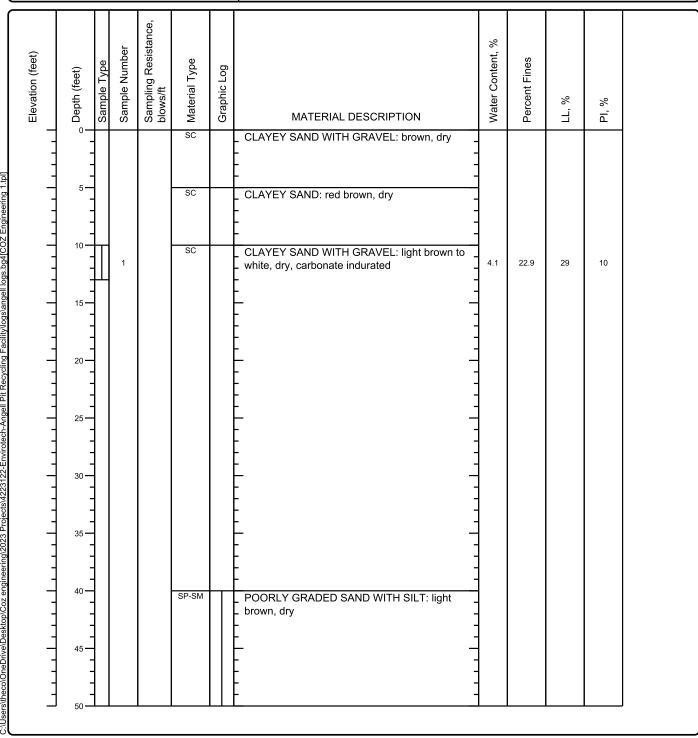


Project Location: 32.849045, -103.678205, Hummingbird Lane, Lea County, NM

Project Number: 4223122

# Log of Boring B-1 Sheet 1 of 2

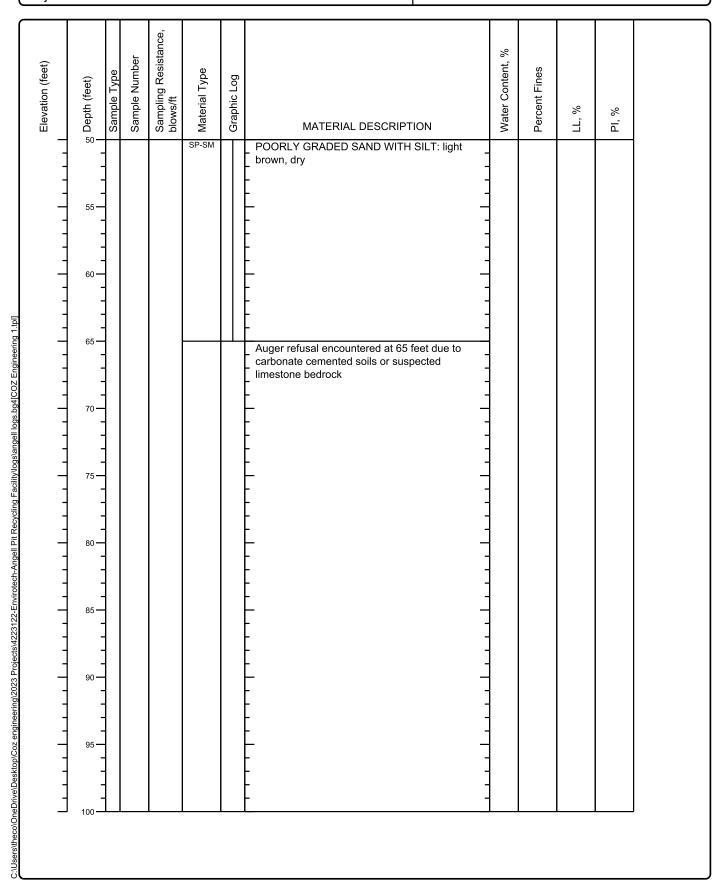
Date(s) 10-11-23 Drilled	Logged By COZ	Checked By COZ
Drilling Method hollow-stem auger	Drill Bit Size/Type	Total Depth of Borehole 65 feet bgs
Drill Rig Type CME-75	Drilling Contractor Southlands	Approximate Surface Elevation
Groundwater Level and Date Measured not encountered	Sampling Method(s) Grab	Hammer Data
Borehole Backfill cuttings	Location see boring location	



Project Location: 32.849045, -103.678205, Hummingbird Lane, Lea County, NM

Project Number: 4223122

Log of Boring B-1
Sheet 2 of 2

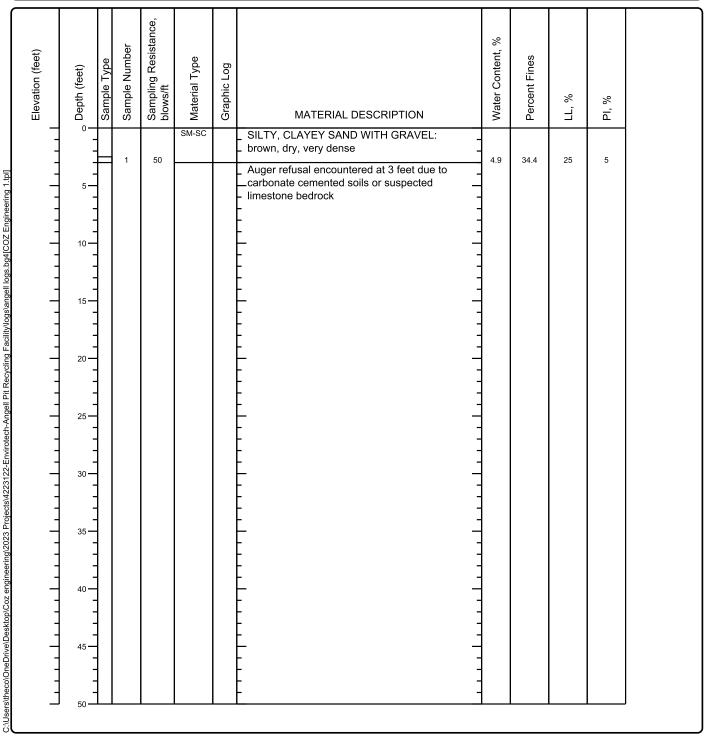


Project Location: 32.849045, -103.678205, Hummingbird Lane, Lea County, NM

Project Number: 4223122

# Log of Boring B-2 Sheet 1 of 1

Date(s) 10-11-23 Drilled	Logged By COZ	Checked By COZ	
Drilling Method hollow-stem auger	Drill Bit Size/Type	Total Depth of Borehole 3 feet bgs	
	Drilling Contractor Southlands	Approximate Surface Elevation	
Groundwater Level and Date Measured not encountered	Sampling Method(s)	Hammer Data	
Borehole Backfill cuttings	Location see boring location		

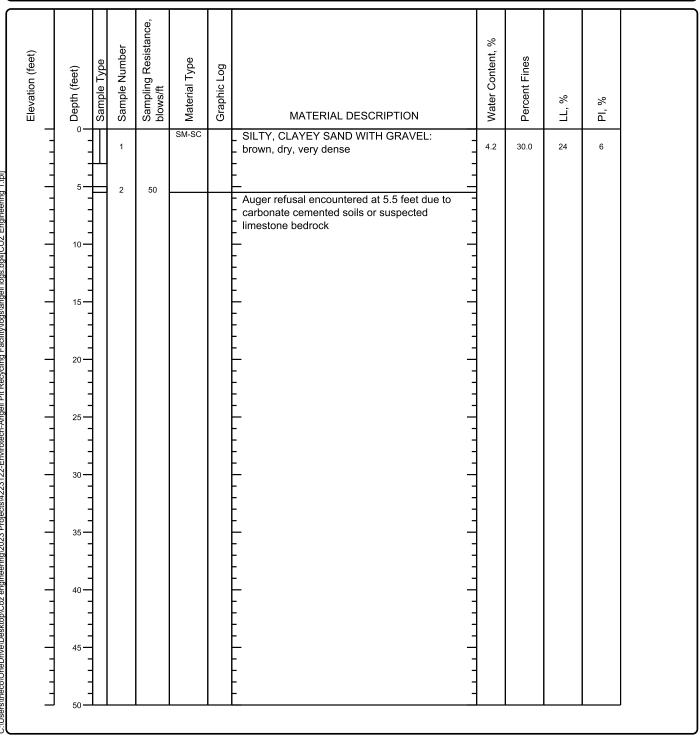


Project Location: 32.849045, -103.678205, Hummingbird Lane, Lea County, NM

Project Number: 4223122

# Log of Boring B-3 Sheet 1 of 1

Date(s) Drilled 10-11-23	Logged By COZ	Checked By COZ
Drilling Method hollow-stem auger	Drill Bit Size/Type	Total Depth of Borehole 5.5 feet bgs
Drill Rig Type CME-75	Drilling Contractor <b>Southlands</b>	Approximate Surface Elevation
Groundwater Level and Date Measured not encountered	Sampling Method(s) Grab, SPT	Hammer Data
Borehole Backfill cuttings	Location see boring location	

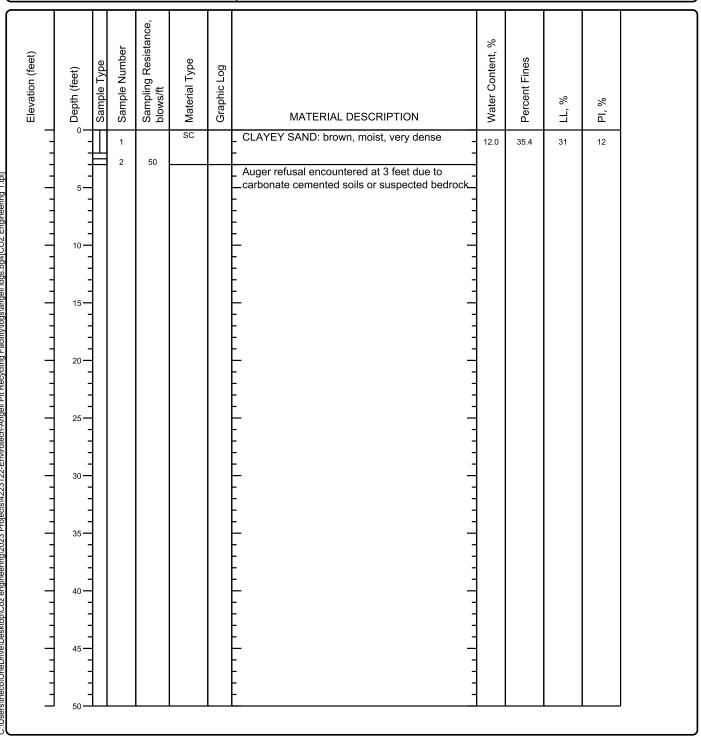


Project Location: 32.849045, -103.678205, Hummingbird Lane, Lea County, NM

Project Number: 4223122

# Log of Boring B-4 Sheet 1 of 1

Date(s) 10-11-23 Drilled	Logged By COZ	Checked By COZ
Drilling Method hollow-stem auger	Drill Bit Size/Type	Total Depth of Borehole 3 feet bgs
Drill Rig Type CME-75	Drilling Contractor Southlands	Approximate Surface Elevation
Groundwater Level and Date Measured not encountered	Sampling Method(s) Grab, SPT	Hammer Data
Borehole Backfill cuttings	Location see boring location	

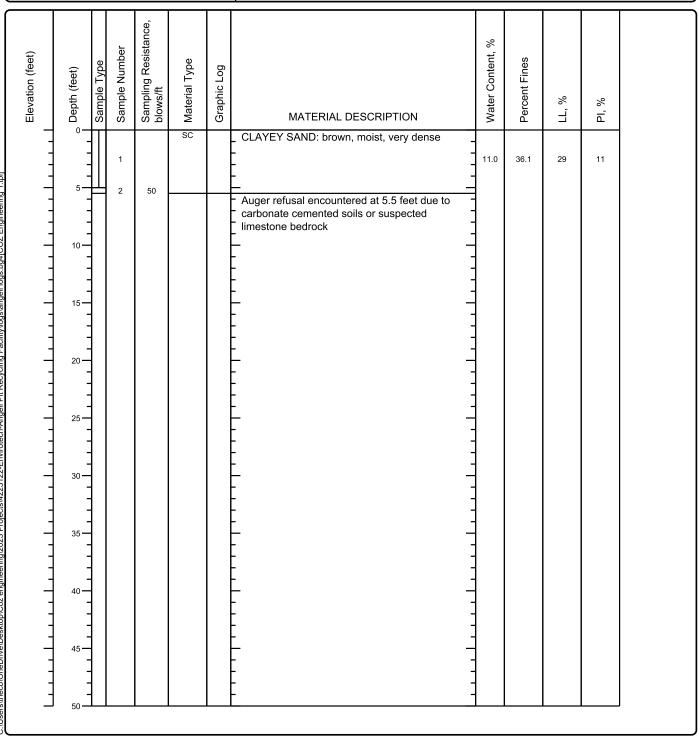


Project Location: 32.849045, -103.678205, Hummingbird Lane, Lea County, NM

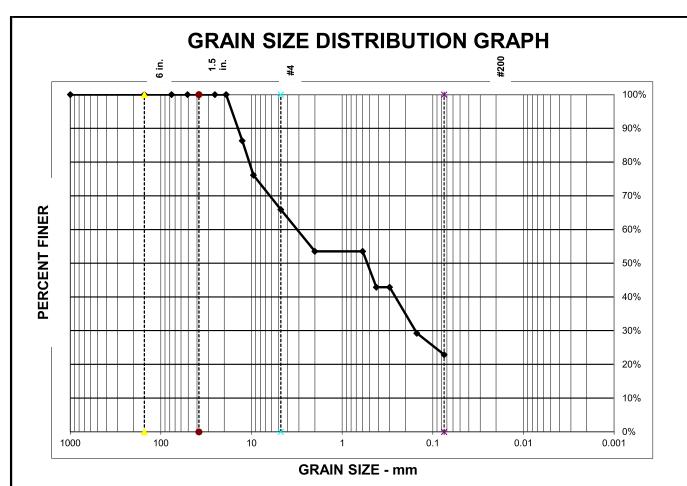
Project Number: 4223122

# Log of Boring B-5 Sheet 1 of 1

Date(s) 10-11-23 Drilled	Logged By COZ	Checked By COZ
Drilling Method hollow-stem auger	Drill Bit Size/Type	Total Depth of Borehole <b>5.5 feet bgs</b>
Drill Rig Type CME-75	Drilling Contractor Southlands	Approximate Surface Elevation
Groundwater Level and Date Measured not encountered	Sampling Method(s) Grab, SPT	Hammer Data
Borehole Backfill cuttings	Location see boring location	



Project: Angell Pit Recycling Facility Project Location: 32.849045, -103.678205, Hummingbird Lane, Lea County, NM Key to Log of Boring Sheet 1 of 1 Project Number: 4223122 Sampling Resistance blows/ft % Sample Number Water Content, Elevation (feet) Percent Fines Material Type Graphic Log Depth (feet) % % Ľ, MATERIAL DESCRIPTION 펍 6 9 10 1 2 7 8 11 12 **COLUMN DESCRIPTIONS** 1 Elevation (feet): Elevation (MSL, feet). Water Content, %: Water content of the soil sample, expressed as Depth (feet): Depth in feet below the ground surface. percentage of dry weight of sample. Sample Type: Type of soil sample collected at the depth interval Percent Fines: The percent fines (soil passing the No. 200 Sieve) in the sample. WA indicates a Wash Sieve, SA indicates a Sieve Sample Number: Sample identification number. Analysis. Sampling Resistance, blows/ft: Number of blows to advance driven 11 LL, %: Liquid Limit, expressed as a water content. sampler one foot (or distance shown) beyond seating interval PI, %: Plasticity Index, expressed as a water content. using the hammer identified on the boring log. Material Type: Type of material encountered. Graphic Log: Graphic depiction of the subsurface material encountered. 8 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive FIELD AND LABORATORY TEST ABBREVIATIONS CHEM: Chemical tests to assess corrosivity PI: Plasticity Index, percent COMP: Compaction test SA: Sieve analysis (percent passing No. 200 Sieve) CONS: One-dimensional consolidation test UC: Unconfined compressive strength test, Qu, in ksf LL: Liquid Limit, percent WA: Wash sieve (percent passing No. 200 Sieve) **MATERIAL GRAPHIC SYMBOLS** Clayey SAND (SC) Silty to Clayey SAND (SM-SC) Poorly graded SAND with Silt (SP-SM) **TYPICAL SAMPLER GRAPHIC SYMBOLS** OTHER GRAPHIC SYMBOLS ■ Water level (at time of drilling, ATD) CME Sampler Pitcher Sample Auger sampler Water level (after waiting) 2-inch-OD unlined split **Bulk Sample** Grab Sample Minor change in material properties within a spoon (SPT) stratum 3-inch-OD California w/ 2.5-inch-OD Modified Shelby Tube (Thin-walled, – Inferred/gradational contact between strata California w/ brass liners brass rings fixed head) -?- Queried contact between strata **GENERAL NOTES** 1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests. 2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times



Sieve Size	1 1/2"	3/4"	3/8"	#4	#10	#40	#100	#200
% Passing (Cumulative)	100%	100%	76%	66%	54%	43%	29%	22.9%
Specification								

 % GRAVEL =
 34%  $D_{85}$  = 12.2
  $D_{15}$  =

 % SAND =
 43%  $D_{60}$  = 3.1
  $D_{10}$  =

 % SILT & CLAY =
 23%  $D_{50}$  = 0.5
  $C_U$  =

  $D_{30}$  = 0.2
  $C_C$  =

**Sample Date:** 10/11/23 **Project No.:** 4223122

Project Name: Angell Pit Recycling Facility

Report Date: 10/25/23 Sample Location: B-1 at 10'

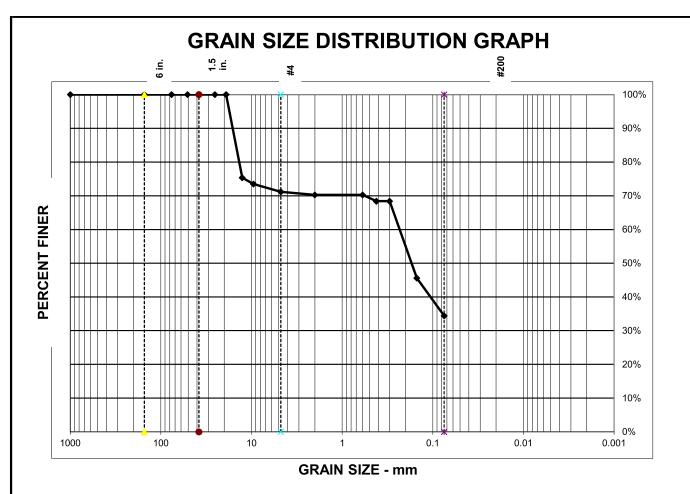
Liquid Limit: 29 Plasticity Index: 10

**USCS Classification:** SC

Material Description: Clayey Sand with Gravel

**Moisture Content:** 4.1%

### COZ Engineering, LLC



Sieve Size	1 1/2"	3/4"	3/8"	#4	#10	#40	#100	#200
% Passing (Cumulative)	100%	100%	73%	71%	70%	68%	46%	34.4%
Specification								

**% GRAVEL =** 29%

 $D_{85} = 14.9$ 

 $D_{15} =$ 

**% SAND =** 37%

 $D_{60} = 0.2$ 

 $D_{10} =$ 

**% SILT & CLAY =** 34%

 $D_{50} = 0.2$ 

C<sub>U</sub> =

 $D_{30} =$ 

 $C_c =$ 

**Sample Date:** 10/11/23 **Project No.:** 4223122

Project Name: Angell Pit Recycling Facility

Report Date: 10/25/23 Sample Location: B-2 at 2.5'

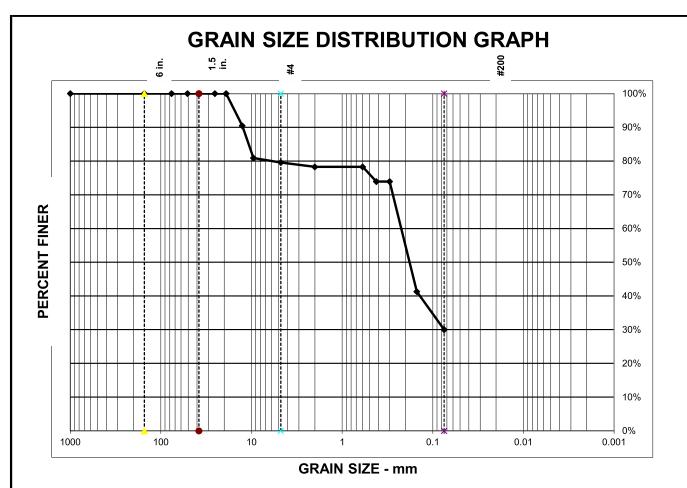
Liquid Limit: 25 Plasticity Index: 5

**USCS Classification: SM-SC** 

Material Description: Silty, Clayey Sand with Gravel

**Moisture Content:** 4.9%

## COZ Engineering, LLC



Sieve Size	1 1/2"	3/4"	3/8"	#4	#10	#40	#100	#200
% Passing (Cumulative)	100%	100%	81%	80%	78%	74%	41%	30.0%
Specification								

% GRAVEL = 20%  $D_{85}$  = 10.8  $D_{15}$  = % SAND = 50%  $D_{60}$  = 0.2  $D_{10}$  = % SILT & CLAY = 30%  $D_{50}$  = 0.2  $C_{U}$  =  $D_{30}$  = 0.1  $C_{C}$  =

**Sample Date:** 10/11/23 **Project No.:** 4223122

Project Name: Angell Pit Recycling Facility

Report Date: 10/25/23 Sample Location: B-3 at 0-5'

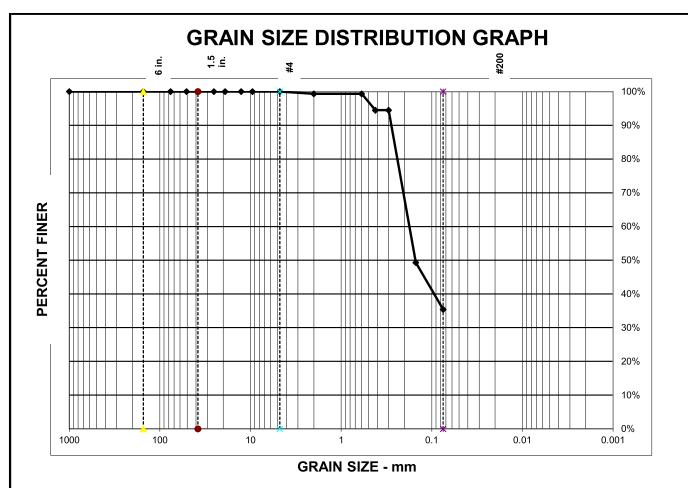
Liquid Limit: 24 Plasticity Index: 6

**USCS Classification: SM-SC** 

Material Description: Silty, Clayey Sand with Gravel

**Moisture Content:** 4.2%

### COZ Engineering, LLC



Sieve Size	1 1/2"	3/4"	3/8"	#4	#10	#40	#100	#200
% Passing (Cumulative)	100%	100%	100%	100%	99%	94%	49%	35.4%
Specification								

**Sample Date:** 10/11/23 **Project No.:** 4223122

Project Name: Angell Pit Recycling Facility

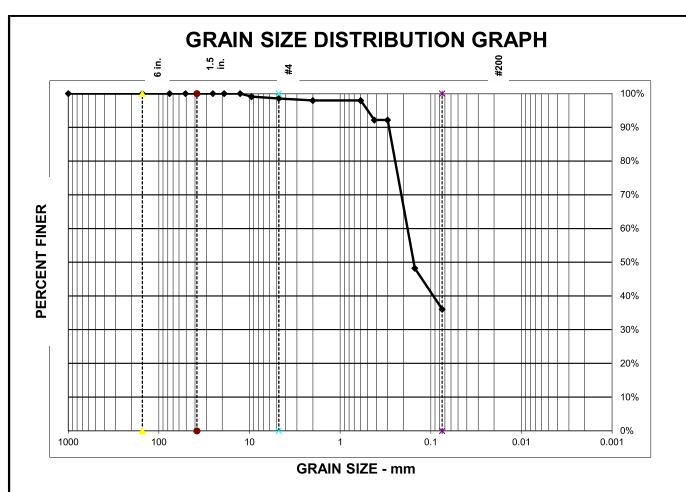
Report Date: 10/25/23 Sample Location: B-4 at 0-3'

Liquid Limit: 31 Plasticity Index: 12

**USCS Classification: SC** 

Material Description: Clayey Sand Moisture Content: 12.0%

### COZ Engineering, LLC



Sieve Size	1 1/2"	3/4"	3/8"	#4	#10	#40	#100	#200
% Passing (Cumulative)	100%	100%	99%	98%	98%	92%	48%	36.1%
Specification								

**Sample Date:** 10/11/23 **Project No.:** 4223122

Project Name: Angell Pit Recycling Facility

Report Date: 10/25/23 Sample Location: B-5 at 0-5'

Liquid Limit: 29 Plasticity Index: 11

**USCS Classification:** SC

Material Description: Clayey Sand Moisture Content: 11.0%

### COZ Engineering, LLC

# **Laboratory Compaction Characteristics of Soil**

# COZ Engineering, LLC

P. O. Box 13331 Las Cruces, NM 88013 575-642-7671

Client Name: Envirotech

Project Name: Angell Pit Recycling Center

Location: Lat.: 32.849045, Long.: -103.678205

Lea County, New Mexico

Source Material: B-1 at 10'

Sample Description: Clayey Sand with Gravel

Proctor #1

Material Designation: SC Sample date: 10/11/2023

Test Method: ASTM-698

Test Procedure:

COZ Sample Preparation:

Rammer: X Manual Mechanical

Maximum Dry Unit Wt.: 121.0 pcf

**TEST RESULTS** 

Project No.: 4223122 Date: 10/25/2023

Optimum Water Content:

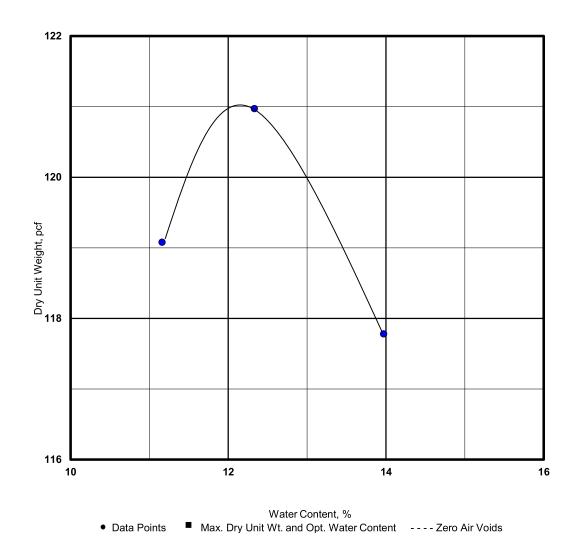
12.1

Liquid Limit: 29 Plastic Limit: 19

Plasticity Index:

% passing # 200 sieve: 23

Reviewed by: Dan Cosper, P. E.



# **Laboratory Compaction Characteristics of Soil**

# COZ Engineering, LLC

P. O. Box 13331 Las Cruces, NM 88013 575-642-7671

Client Name: Envirotech

Project Name: Angell Pit Recycling Center

Location: Lat.: 32.849045, Long.: -103.678205

Lea County, New Mexico

Source Material: B-3 at 0-5'

Sample Description: Silty, Clayey Sand with Gravel

Proctor #2

Material Designation: SM-SC Sample date: 10/11/2023

Test Method: ASTM-698

Test Procedure: B

Sample Preparation: COZ

Rammer: Mechanical X Manual

Maximum Dry Unit Wt.: 109.8 pcf

**TEST RESULTS** 

Project No.: 4223122 Date: 10/25/2023

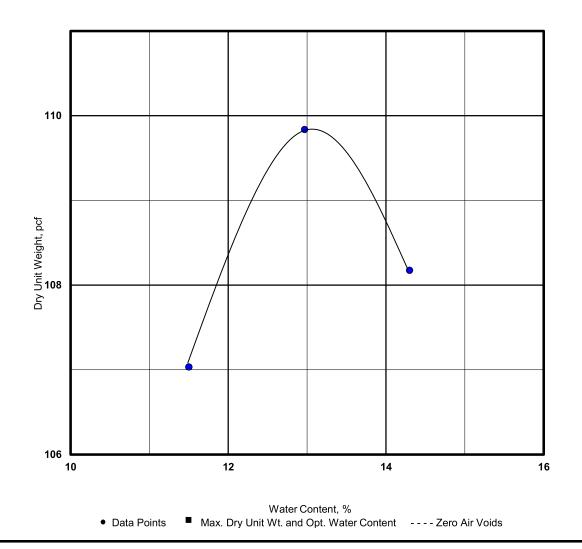
Optimum Water Content: 13.0

Liquid Limit: 24 Plastic Limit: 18

Plasticity Index: 6

% passing # 200 sieve: 30

Reviewed by: Dan Cosper, P. E.



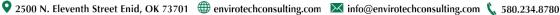


**C147L REGISTRATION PACKAGE ANGELL RECYCLE FACILITY** SECTION 8, TOWNSHIP 17 SOUTH, RANGE 33 EAST LEA COUNTY, NEW MEXICO 023249-00

# **APPENDIX C**

# **ENGINEERING DRAWINGS**







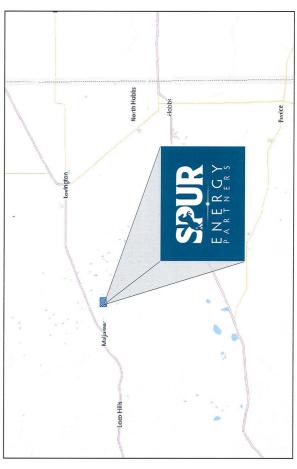
C

# ANGELL RECYCLE FACILITY SPUR ENERGY PARTNERS

SECTION 8, TOWNSHIP 17 SOUTH, RANGE 33 EAST

32° 50' 56.8788" N, 103° 40' 37.1388" W 32.849133°, -103.676983°





# INDEX TO DRAWINGS

DESCRIPTION SHEET NO.

PIT CAPACITIES RUB SHEET & FENCE PLAN CROSS SECTIONS CROSS SECTIONS **EXISTING SITE FEATURES** PROJECT LOCATION COVER SHEET SITE PLAN

**CROSS SECTIONS** 

12/15/2023 SSIONAL ENONVEER AN MEKO

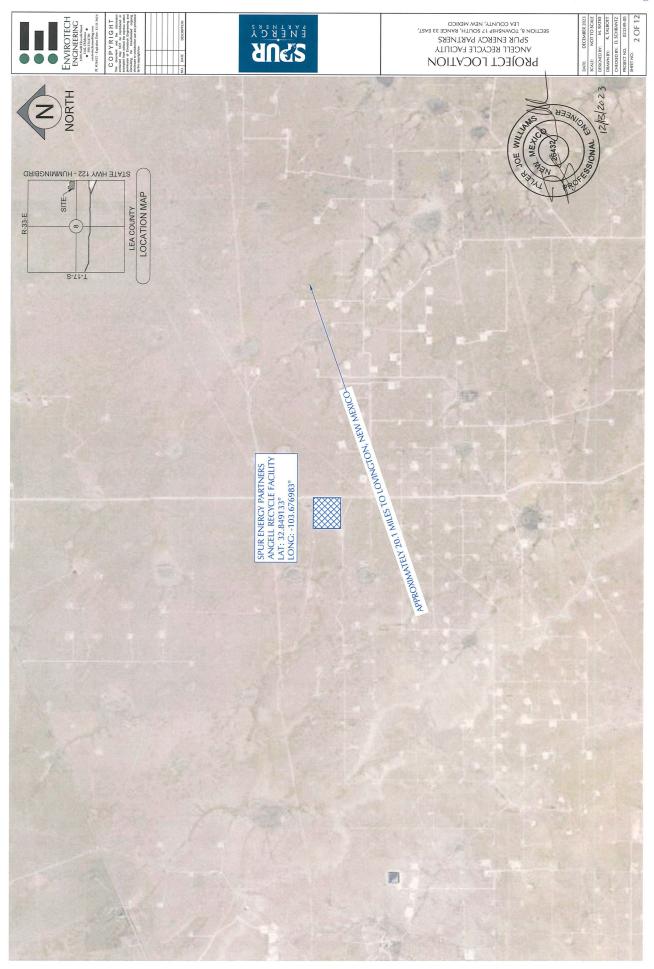
ENVIROTECH ENGINEERING

2500 N. Eleventh Street Enid, OK 73701 • 580.234.8780 • envirotechconsulting.com License #26432 - Expiration Data: 12-31-2024

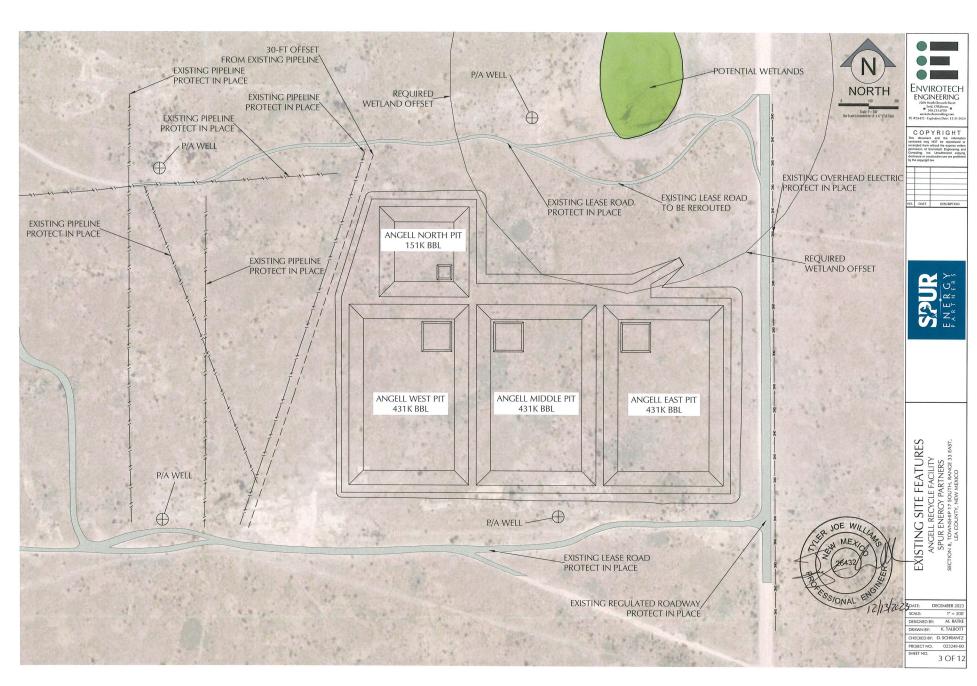
# CONTACTS

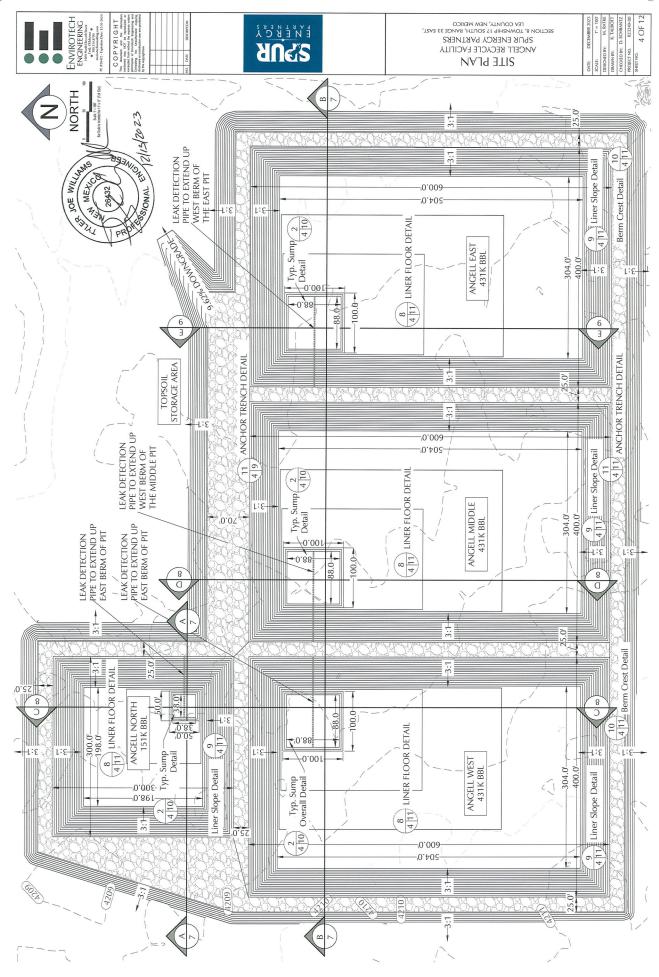
ENVIROTECH ENGINEERING & CONSULTING - MITCHELL RATKE, EIT (580)-234-8780 (DESIGN ENGINEER) ENVIROTECH ENGINEERING & CONSULTING - DOUG SCHRANTZ, PE (580)-234-8780 (SUPERVISING ENGINEER) HUNTER SPRAGG - SPUR ENERGY PARTNERS - (817)-914-0987

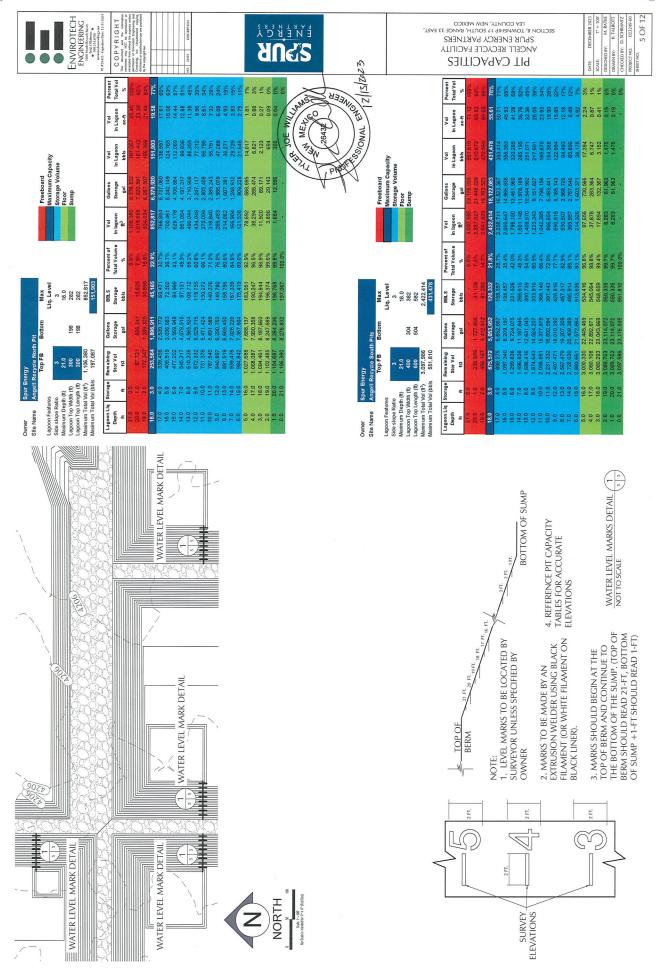




Received by OCD: 12/20/2023 12:20:09 PM









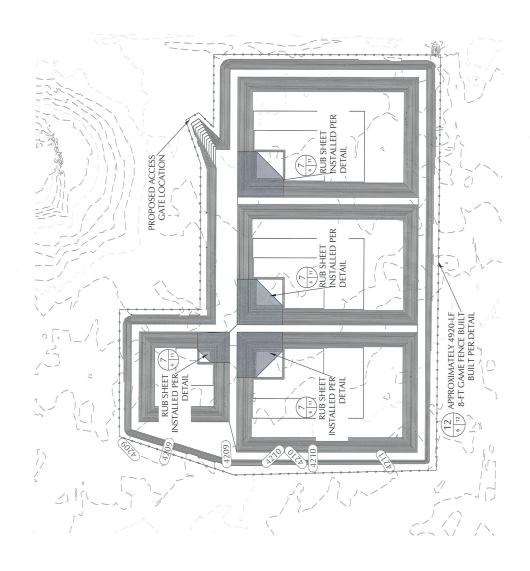
FOR CONALY, NEW MEXICO SECULON 8, TOWNSHIP TO SOUTH, SANCE 33 EAST, ANGELL RECYCLE FACILLITY SALENCE PLANCE PLANCE

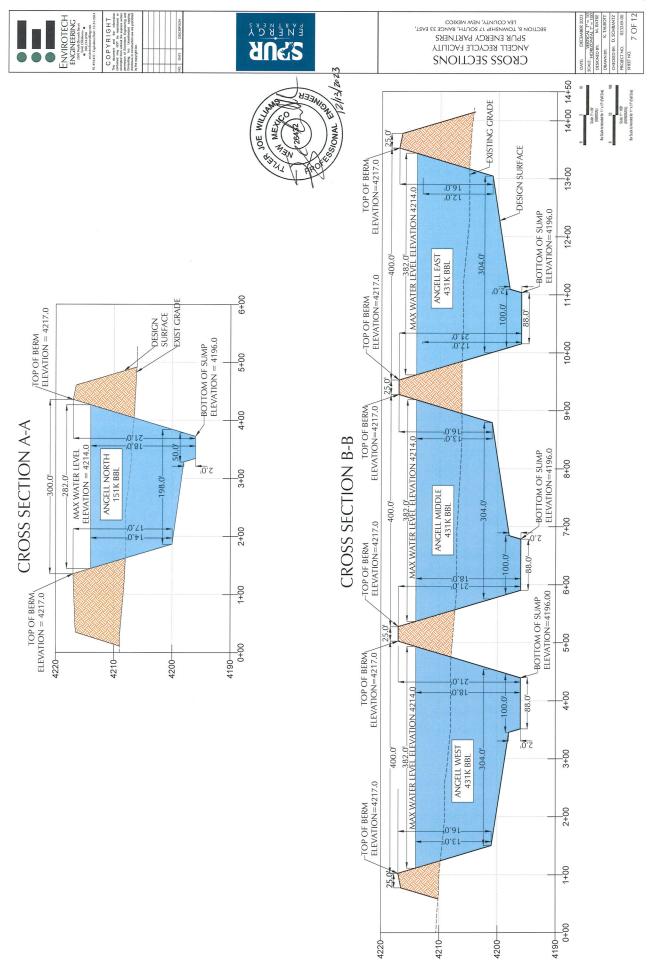


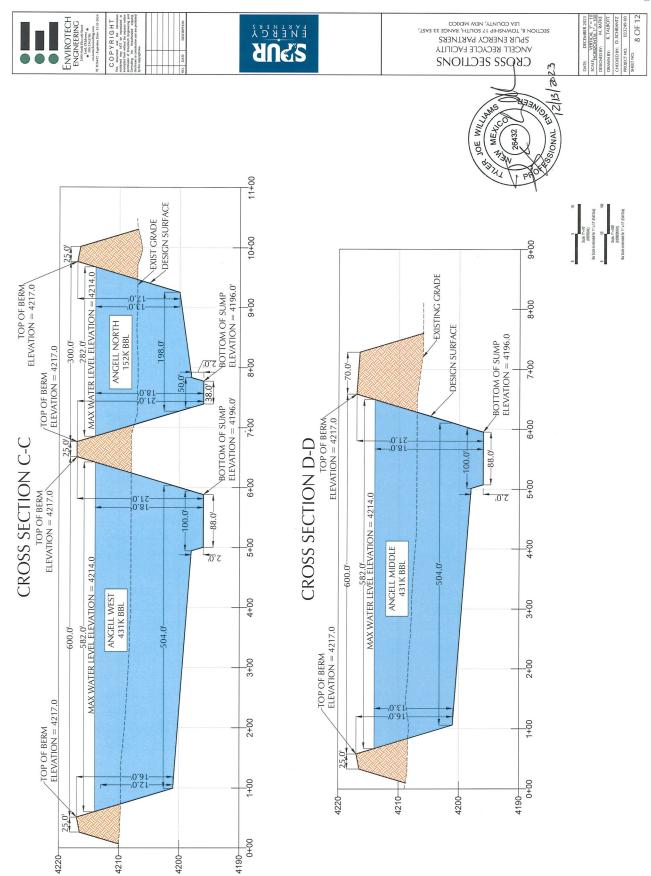
Envirotech 11X17 std.ctb









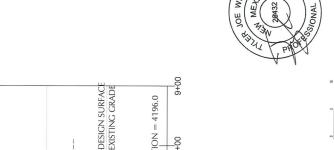


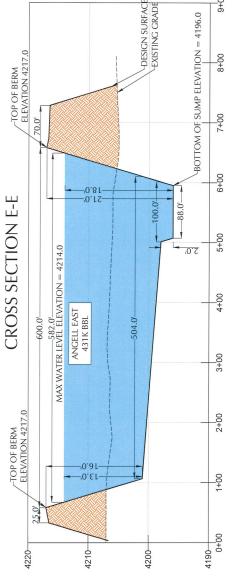
9 OF 12



TEV COUNTY, NEW MEXICO
SECTION 65, TOWASHIP 12 SOUTH, SEAUCE 32 EAST,
ANGELL RECYCLE FACILLITY
CROSS SECTIONS



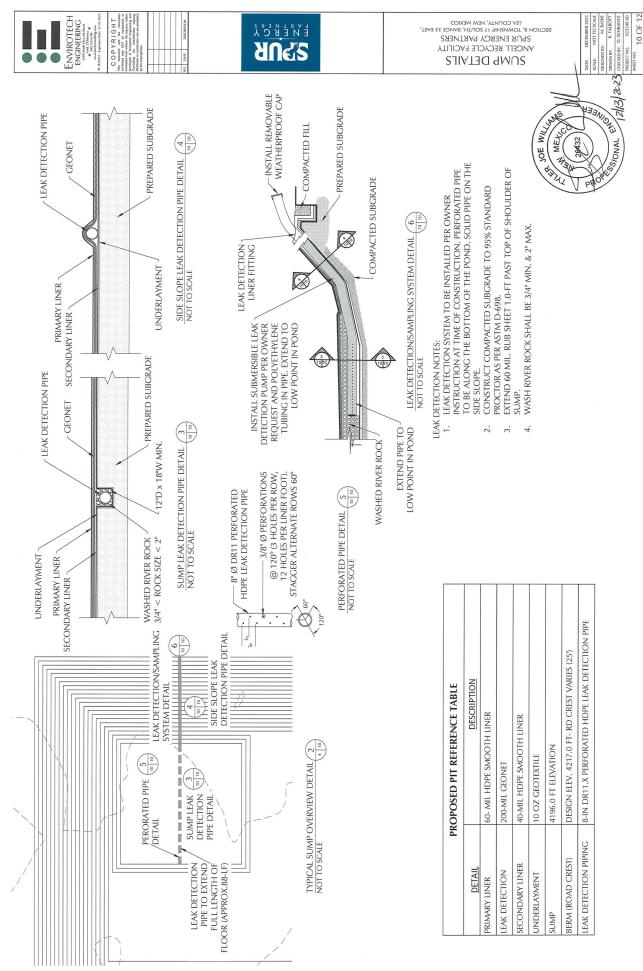




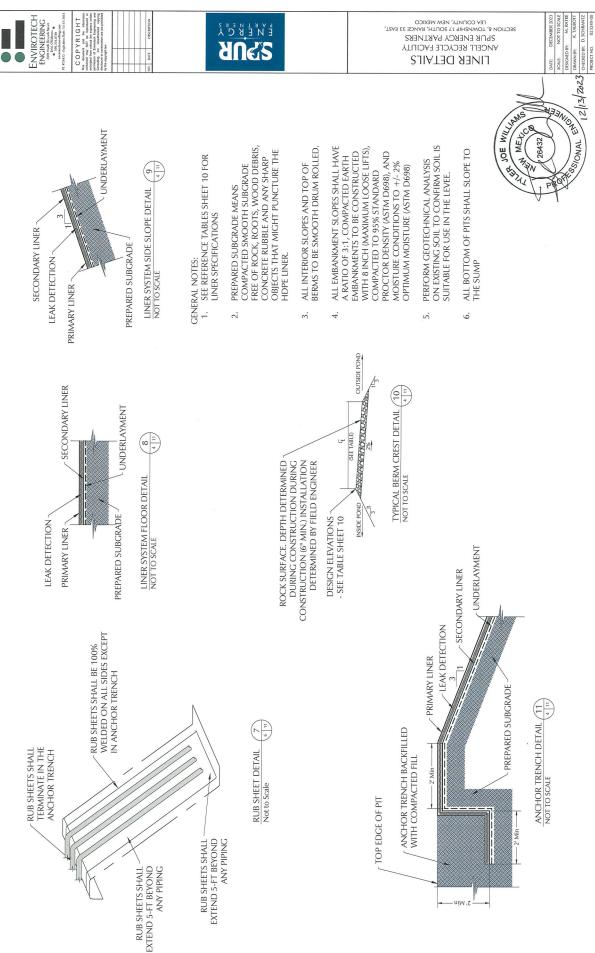
4210-

4220-

4200-



11 OF 12



WHERE

LOCATION

EACH

FENCE NOTES:



ANGELL RECYCLE FACILITY
SPUR ENERGY PARTNERS
SECTION 8, TOWNSHIP 77 SOUTH, RANGE 33 EAST, *LENCE DETAILS* 



12/13/2020 -8810NAL ENGINE JOE WILLIAM MEXI

SPUR SPUR

1/2 FT. INTO THE GROUND. THE ROD SHALL BE CONNECTED TO EACH WIRE WITH A MINIMUM AWG NO. 8 STRANDED COPPER WIRE, GROUNDING WILL NOT BE TRANSMISSION, DISTRIBUTION OR SECONDARY LINE CROSSES A BARRIER FENCE, THE CONTRACTOR SHALL FURNISH AND INSTALL A GROUND CONFORMING TO ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE- THE GROUND ROD SHALL 0E A MINIMUM DIAMETER OF 1/2-IN. AND 8-FT. IN LENGTH, AND DRIVEN AT LEAST 7 PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK,

LINE BRACE POSTS SHALL BE SPACED AT 400 FT. INTERVALS, WHERE FENCING IS CONTINUOUS AND WHERE END, CORNER AND LINE BRACE POSTS ARE NOT SPECIFIED.

FT. LONG. ALL END, CORNER AND LINE BRACE POSTS SHALL BE 6 IN. MIN. DIAMETER AND 12 FT. LONG. ALL LINE POSTS SHALL BE 5 IN. MIN. DIAMETER AND 12 BARBED WIRE SHALL BE DOUBLE WRAPPED AND TIED

OFF AT END POSTS, CORNER POSTS AND LINE BRACE

POSTS. WOVEN WIRE SHALL BE SINGLE WRAPPED AND TIED OFF. FENCE TO BE CONTINUED, SHALL BE AASHTO M 279 (ASTM A 116) DESIGN NO. 1047-6-11 WOVEN WIRE FENCE FABRIC SHALL CONFORM TO RESTARTED IN LIKE MANNER. 5.

WITH CLASS I COATING. STEEL BARBED WIRE SHALL CONFORM TO AASHTO M 200 9

ALL FENCE WIRE TIES, BRACE WIRES, STAPLES AND OTHER APPURTENANCES SHALL BE GALVANIZED (ASTM A 121) 12-1/2 GAGE WITH CLASS 1 COATING. WIRE

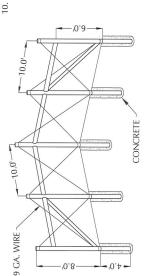
RE-ESTABLISHING DISTURBED OR DESTROYED SURVEY RESPONSIBLE CONFORMANCE WITH AASHTO M 232. CONTRACTOR SHALL BE 뽀

MONUMENTS TO THE APPROPRIATE ACCURACY.
ALL MISCELLANEOUS HARDWARE SHALL BE FURNISHED
GALVANIZED OR ALUMINUM COATED. ALL METAL PIPE 6

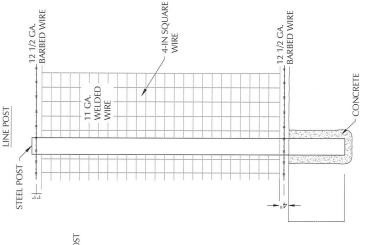
**CORNER POST** 

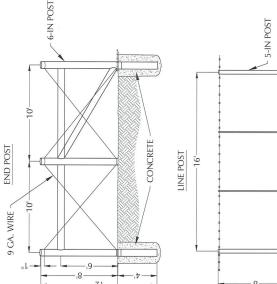
CONCRETE

READY MIX CONCRETE MAY BE USED AS A SUBSTITUTE FOR CLASS "A" CONCRETE FOR THE CONCRETE FOOTING IF APPROVED BY THE ENGINEER. POSTS SHALL BE CAPPED.











**C147L REGISTRATION PACKAGE ANGELL RECYCLE FACILITY** SECTION 8, TOWNSHIP 17 SOUTH, RANGE 33 EAST LEA COUNTY, NEW MEXICO 023249-00

# APPENDIX D

# **DESIGN AND CONSTRUCTION PLAN**

D



DESIGN & CONSTRUCTION PLAN
SPUR ENERGY PARTNERS
ANGELL RECYCLE
LEA COUNTY, NEW MEXICO
023249-00

Spur Energy is proposing to construct four (4) storage pits in Section 8, Township 17 South, Range 33 East, Lea County, New Mexico. Bish Recycle shall consist of four (4) containments with a total operational volume of approximately 1,446,337-bbl. The facility will have one containment that holds a capacity of 151,903-bbl and three containments that hold a capacity of 431,478-bbl each.

# **OPERATION AND MAINTENANCE PROCEDURES**

Applicable mandates in Rule 34 are <u>underlined</u>. This plan addresses construction of lined earthen containments. *Appendix D* presents Engineering Design Plans. *Appendix F* provides liner and geotextile specifications.

Field conditions may create the need for minor modification of the containment design (e.g. changing the length, width, or depth.)

# **Dike Protection and Structural Integrity**

Design elements are addressed in the section of this submission containing the foundation recommendations. The recommendations are based on site-specific data. The operator, engineer, and selected contractor will review the recommendations prior to beginning the earthwork and adhere to the specific recommendations.

The design and operation provide for the confinement of produced water to prevent releases and to prevent overtopping due to wave action or rainfall. Additionally, the design prevents run-on of surface water as the containment is surrounded by an above-grade levee (berm) and diversion ditch to prevent run-on of surface water.

# **Stockpile Topsoil**

Where topsoil is present, <u>prior to constructing containment</u>, the <u>operator will strip and stockpile the topsoil for use as the final cover or fill at the time of closure</u>. The topsoil will be stockpiled in the designated area from the Engineering Design Plans.

#### Signage

The design calls for an upright sign no less than 12-in by 24-in with lettering not less than two inches in height in a conspicuous place on the fence surrounding the containment. The sign is posted in a manner and location such that a person can easily read the legend. The sign will provide the following information:

- 1. The operator's name,
- 2. The location of the site by quarter-quarter or unit letter, section, township and range, and
- 3. Emergency telephone numbers.





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# **Fencing**

The design provides for a fence to enclose the Recycling Containment in a manner that deters unauthorized wildlife and human access. The design calls for a 6-ft tall chain link security fence around the containment to exclude wildlife (see detail contained in engineering design drawings). This fence provides greater wildlife (and human) deterrence than the minimum required <u>barbed wire fence with four strands evenly spaced in the interval between one foot and four feet above ground level</u>. The fence will be gated to provide access for maintenance and placement of pumps and other necessary equipment. As stated in the O&M plan, <u>the operator will ensure that all gates associated with the fence are closed and locked when responsible personnel are not onsite</u>.

# **Netting and Protection of Wildlife**

The game fence on the containment levee will be effective in excluding antelope, deer, coyotes, and most other terrestrial wildlife.

The Recycling Containment is otherwise protective of wildlife, including migratory birds. The containment will contain treated produced water that has not shown to be a material threat to birds due to hydrogen sulfide gas or floating, free-phase hydrocarbons. The O&M plan calls for the operator to inspect for and, within 30 days of discovery, report the discovery of dead migratory birds or other wildlife to the appropriate wildlife agency ad to the division district office in order to facilitate assessment and implementation of measures to prevent incidents from reoccurring.

The 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. Geotextile may be placed under the liner when needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity.

# Appendix D shows:

- 1. The levee has an inside grade no steeper than three horizontal feet to one vertical foot (3H:1V).
- 2. The levee outside grade is no steeper than three horizontal feet to one vertical foot (3H:1V).
- 3. The top of the levee is wide enough to install an anchor trench and provide adequate room for inspection and maintenance.
- 4. The caliche gravel placed on the outside levee provides additional erosion control.

Field conditions may create the need for changes to the design. Any changes to the construction or grade requirements due to unforeseen conditions will be reviewed and approved prior to initiating installation of the liner system. Any design change that does not conform to the NMOCD Rule will be the subject of a variance request and will be submitted to the OCD for review and approval.



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# **LINER AND DRAINAGE GEOTEXTILE INSTALLATION**

The containment has <u>a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions.</u>

The primary (upper) liner is a geomembrane liner composed of an impervious, synthetic material that is resistant to ultraviolet light, petroleum hydrocarbons, salts and acidic and alkaline solutions. It is 60-mil HDPE. The secondary liner is 40-mil HDPE. Liner compatibility meets or exceeds a subsequent relevant publication to EPA SW-846 method 9090A.

The Recycling Containment design has a leak detection system between the upper and lower geomembrane liners of 200-mil geonet to facilitate drainage. The leak detection system consists 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. The containment floor design calls for a slope toward the sump. This slope, combined with the highly transmissive geonet drainage layer, provides for the earliest possible leak detection.

The liners and drainage material will be installed consistent with the manufacture's specifications (See *Appendix F*). In addition to any specifications of the manufacturer, protocols for liner installation include measures to:

- 1. Minimize liner seams and orient them up and down, not across, a slope of the levee.
- 2. <u>Use factory welded seams where possible.</u>
- 3. <u>Field seams in geosynthetic material are thermally seamed; prior to field seaming, overlap liner</u> four to six inches.
- 4. Minimize the number of field seams and corners and irregularly shaped areas.
- 5. Provide for no horizontal seams within five feet of the slope's toe.
- 6. Use qualified personnel to perform field welding and testing.
- 7. Avoid excessive stress-strain on the liner.
- 8. The edges of all liners are anchored in the bottom of a compacted earth-filled trench that is at least 18-in deep.

At points of discharge into the lined earthen containment, the pipe configuration effectively protects the liner from excessive hydrostatic force or mechanical damage during filling. The design shows that at any point of discharge into or suction from the recycling containment, the liner is protected from excessive hydrostatic force or mechanical damage. External discharge or suction lines do not penetrate the liner.

Pumping from the containment to hydraulic fracturing operations is the responsibility of stimulation contractors. Typically, numerous lines are permanently placed in the containment with floats attached to prevent damage to the liner system. The containment may be equipped with permanent HDPE stinger (supported by a sacrificial liner or geotextile) for withdrawal of fluid during operations, if the owner deems necessary. External discharge or suction lines do not penetrate the liner.



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#### **LEAK DETECTION AND FLUID REMOVAL SYSTEM INSTALLATION**

The leak detection system, contains the following design elements:

- 1. The 200-mil geonet drainage material between the primary and secondary liner is sufficiently permeable to allow the transport of fluids to the observation ports (*Appendix D*).
- 2. The containment floor, sloped towards the monitoring riser pipe, facilitates the earliest possible leak detection of the containment bottom. A pump may be placed in an observation port to provide for fluid removal.
- 3. Piping will withstand chemical attack from any seepage, structural loading from stresses and disturbances from overlying water, cover materials, equipment operation, and expansion or contraction (see *Appendix D*).
- 4. The slope of the interior subgrade should be great enough to facilitate drainage.



**C147L REGISTRATION PACKAGE ANGELL RECYCLE FACILITY** SECTION 8, TOWNSHIP 17 SOUTH, RANGE 33 EAST LEA COUNTY, NEW MEXICO 023249-00

# **APPENDIX E**

# **MATERIAL SPECIFICATIONS**

Ε



Spur Energy is proposing to construct four (4) storage pits in Section 8, Township 17 South, Range 33 East, Lea County, New Mexico. Bish Recycle shall consist of four (4) containments with a total operational volume of approximately 1,446,337-bbl. The facility will have one containment that holds a capacity of 151,903-bbl and three containments that hold a capacity of 431,478-bbl each.

#### GEOMEMBRANE SPECIFICATION

This specification covers the technical requirements for the Manufacturing and Installation of the geomembrane. All materials meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these project specifications.

#### 1.1 REFERENCES

- A. American Society for Testing and Materials (ASTM)
  - 1. D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
  - 2. D 1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
  - 3. D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
  - 4. D 1603 Test Method for Carbon Black in Olefin Plastics
  - 5. D 3895 Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
  - 6. D 4218 Standard Test Method for Determination of Carbon Black in Polyethylene Compounds
  - 7. D 4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
  - 8. D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
  - 9. D 5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
  - 10. D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
  - 11. D 5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes
  - 12. D 6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
  - 13. D 6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
  - 14. D 7240 Standard Practice for Leak Location using Geomembranes with an Insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive Geomembrane Spark Test)
- B. Geosynthetic Research Institute
  - 1. GRI GM 13 Test Properties, Testing Frequency and Recommended Warranty for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
  - 2. GRI GM 17 Test Properties, Testing Frequency and Recommended Warranty for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes



#### 1.2 **DEFINITIONS**

- A. Lot A quantity of resin (usually the capacity of one rail car) used in the manufacture of geomembranes. Finished roll will be identified by a roll number traceable to the resin lot used.
- B. Construction Quality Assurance Consultant (CONSULTANT) The Party, independent from MANUFACTURER and INSTALLER, that is responsible for observing and documenting activities related to quality assurance during the lining system construction.
- C. ENGINEER- The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.
- D. Geomembrane Manufacturer (MANUFACTURER) The party responsible for manufacturing the geomembrane rolls.
- E. Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY) The Party, independent from the OWNER, MANUFACTURER, and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER.
- F. INSTALLER- The Party responsible for field handling, transporting, storing, deploying, seaming, and testing of the geomembrane seams.
- G. Panel- Unit area of geomembrane that will be seamed in the field that is larger than 100-ft².
- H. Patch Unit area of geomembrane that will be seamed in the field that is less than 100-ft<sup>2</sup>.
- I. Subgrade Surface Soil layer surface which immediately underlies the geosynthetic material(s).

#### 1.3 SUBMITTALS POST-AWARD

- A. Furnish the following product data, in writing, to ENGINEER prior to installation of the geomembrane material:
  - 1. Resin Data shall include the following:
  - a. Certification stating that the resin meets the specification requirements (see *Table 1.9B*).
  - 2. Geomembrane Roll
  - a. Statement certifying no recycled polymer and no more than 10% rework of the same type of material is added to the resin (product run may be recycled).
- B. The INSTALLER shall furnish the following information to the ENGINEER and OWNER prior to installation:
  - 1. Installation layout drawings
  - 2. Must show proposed panel layout including field seams and details
  - 3. Must be approved prior to installing the geomembrane
  - 4. Approved drawings will be for concept only; actual panel placement will be determined by site conditions.
  - 5. Installer's Geosynthetic Field Installation Quality Assurance Plan





- C. The INSTALLER will submit the following to the ENGINEER upon completion of installation:
  - Certificate stating the geomembrane has been installed in accordance with the Contract Documents
  - 2. Material and installation warranties
  - 3. As-built drawings showing actual geomembrane placement and seams including typical anchor trench detail

# 1.4 QUALITY ASSURANCE

A. The OWNER will engage and pay for the services of a Geosynthetic Quality Assurance Consultant and Laboratory to monitor geomembrane installation.

### 1.5 QUALIFICATIONS

- A. MANUFACTURER
  - 1. Geomembrane shall be manufactured by the following:
    - a. GSE Lining Technology, LLC
    - b. approved equal
  - 2. MANUFACTURER shall have manufactured a minimum of 10,000,000 square feet of polyethylene geomembrane during the last year.

#### B. INSTALLER

- 1. Installation shall be performed by one of the following installation companies (or approved equal)
  - a. GSE Lining Technology, LLC
  - b. GSE Approved Installers
- 2. INSTALLER shall have installed a minimum of 5,000,000-ft<sup>2</sup> of HDPE geomembrane during the last two years.
- 3. INSTALLER shall have worked in a similar capacity on at least 5 projects similar in complexity to the project described in the contract documents, and with at least 500,000-ft<sup>2</sup> of HDPE geomembrane installation on each project.
- 4. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.
- 5. The INSTALLER shall provide a minimum of one Master Seamer for work on the project.
- 6. Must have completed a minimum of 1,000,000-ft<sup>2</sup> of geomembrane seaming work using the type of seaming apparatus proposed for the use on this Project.

# 1.6 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

- A. LABELING Each roll of geomembrane delivered to the site shall be labeled by the MANUFACTURER. The label will identify:
  - 1. manufacturer's name
  - 2. product identification
  - 3. thickness
  - 4. length
  - 5. width
  - 6. roll number





- B. DELIVERY Rolls of liner will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.
- C. STORAGE The on-site storage location for geomembrane material, provided by the CONTRACTOR to protect the geomembrane from punctures, abrasions and excessive dirt and moisture, should have the following characteristics:
  - 1. level (no wooden pallets)
  - 2. smooth
  - 3. dry
  - 4. protected from theft and vandalism
  - 5. adjacent to the area being lined
- D. Handling- Materials are to be handled so as to prevent damage.

#### 1.7 WARRANTY

- A. Material shall be warrantied, on a pro-rata basis, against Manufacturer's defects for a period of 5 years from the date of geomembrane installation.
- B. Installation shall be warrantied against defects in workmanship for a period of 1 year from the date of geomembrane completion.

#### 1.8 GEOMEMBRANE PROPERTIES

- A. Material shall be smooth/textured polyethylene geomembrane as shown on the drawings.
- B. Resin
  - 1. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane.
  - 2. Natural resin (without carbon black) shall meet the following requirements:

Table 1.9B RAW MATERIAL PROPERTIES						
Property	Test Method	HDPE	LLDPE			
Density (g/cm3)	ASTM D 1505	<u>&gt;</u> 0.93	<u>&gt;</u> 0.915			
Melt Flow Index (g/10 min)	ASTM D 1238 (190/2.16)	<u>&lt;</u> 1.0	<u>&lt;</u> 1.0			
OIT (minutes)	ASTM D 3895 (1 atm/200°C)	<u>&gt;</u> 100	<u>&gt;</u> 100			

#### C. Geomembrane Rolls

- 1. Do not exceed a combined maximum total of 1 percent by weight of additives other than carbon black.
- 2. Geomembrane shall be free of holes, pinholes as verified by on-line electrical detection, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.
- Geomembrane material is to be supplied in roll form. Each roll is to be identified with labels indicating roll number, thickness, length, width, and MANUFACTURER.



- 4. All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical property requirements listed in section 1.09 D and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.
- D. Smooth surfaced geomembrane shall meet the requirements shown in the following data sheets below:
  - 1. Table 1.1 for Black HDPE
  - 2. Table 1.2 for Green HDPE
  - 3. Table 1.3 for White HDPE
    - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
    - b. The white surface shall be installed upwards.
  - 4. Table 1.4 for Smooth Leak Location Liner HDPE
    - a. The geomembrane shall have a coextruded, electrically conductive layer.
    - b. The conductive layer is installed downward.
    - c. Electrical testing shall be performed after liner installation by the INSTALLER.
  - 5. Table 1.5 for Smooth White Leak Location Liner HDPE
    - a. The geomembrane shall have a coextruded, electrically conductive layer.
    - b. The conductive layer is installed downward.
    - c. The geomembrane shall be a white-surfaced, coextruded geomembrane.
    - d. The white surface shall be installed upwards.
    - e. Electrical testing shall be performed after liner installation by the INSTALLER.
  - 6. Table 1.6 for Black LLDPE
  - 7. Table 1.7 for White-surfaced LLDPE
    - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
    - b. The white surface shall be installed upwards.
  - 8. Table 1.8 for Leak Location Liner LLDPE
    - a. The geomembrane shall have a coextruded, electrically conductive layer.
    - b. The conductive layer is installed downward.
    - c. Electrical testing shall be performed after liner installation by the INSTALLER.
  - 9. Table 1.9 for White Leak Location Liner LLDPE
    - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
    - b. The white surface shall be installed upwards.
    - c. The geomembrane shall have a coextruded, electrically conductive layer.
    - d. The conductive layer is installed downward.
    - e. Electrical testing shall be performed after liner installation by the INSTALLER.



TARLE 1.1. CSE HD SMOC	TABLE 1.1: GSE HD SMOOTH GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimu	n Average	- Values			
		30 mil	40 mil	60 mil	80 mil	100 mil		
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	30 27	40 36	60 54	80 72	100 90	
Density, g/cm <sup>3</sup> , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940	
Tensile Properties (each direction) Strength at Break, lb/inwidth Strength at Yield, lb/inwidth Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	114 63 700 12	152 84 700 12	228 126 700 12	304 168 700 12	380 210 700 12	
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70	
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	54	72	108	144	180	
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(1)</sup>	Note <sup>(1)</sup>	Note <sup>(1)</sup>	Note <sup>(1)</sup>	Note <sup>(1)</sup>	
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300	
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100	>100	
Typical Roll Dimensions								
Roll Length <sup>(2)</sup> , ft			1,120	870	560	430	340	
Roll Width <sup>(2)</sup> , ft			22.5	22.5	22.5	22.5	22.5	
Roll Area, ft <sup>2</sup>			25,200	19,575	12,600	9,675	7,650	

# • NOTES:

- <sup>(1)</sup>Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- <sup>(2)</sup>Roll lengths and widths have a tolerance of  $\pm$  1%.
- GSE HD Smooth is available in rolls weighing approximately 4,000 lb.
- All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.
- \*Modified.



·							
TABLE 1.2: GSE GREEN	SMOOTH GEOM	MEMBRANE					
Tested Property	Test Method	Frequency	Minimu	m Average	e Values		
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm³, (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, Ib/in-width Strength at Yield, Ib/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	114 63 700 12	152 84 700 12	228 126 700 12	304 168 700 12	380 210 700 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	54	72	108	144	180
Carbon Black Content <sup>(1)</sup> , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100	>100
Typical Roll Dimensions	5						
Roll Length <sup>(3)</sup> , ft			1,120	870	560	430	340
Roll Width <sup>(3)</sup> , ft			22.5	22.5	22.5	22.5	22.5
Roll Area, ft <sup>2</sup>			25,200	19,575	12,600	9,675	7,650



- (1) GSE Green Smooth may have an overall ash content of 3.0% due to the green layer. These values apply to the black layer only.
- <sup>(2)</sup>Dispersion applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- $^{(3)}$ Roll lengths and widths have a tolerance of  $\pm$  1%.
- •GSE Green Smooth is available in rolls weighing approximately 4,000 lb.
- •All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.
- \*Modified.

TABLE 1.3: GSE WHITE SM	OOTH GEOMEMI	BRANE					
Tested Property	Test Method	Frequency	Minimum	Average \	/alues		
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm <sup>3</sup> , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.94 0
Tensile Properties (each direction) Strength at Break, lb/inwidth Strength at Yield, lb/inwidth Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	114 63 700 12	152 84 700 12	228 126 700 12	304 168 700 12	380 210 700 12
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	54	72	108	144	180
Carbon Black Content <sup>(1)</sup> , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(</sup>
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100	>10 0
Typical Roll Dimensions							
Roll Length <sup>(3)</sup> , ft			1,120	870	560	430	340
Roll Width <sup>(3)</sup> , ft			22.5	22.5	22.5	22.5	22.5



Roll Area, ft <sup>2</sup>	25,200	19,575	12,600	9,675	7,65 0	
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- •(1)GSE White Smooth may have an overall ash content of 3.0% due to the white layer. These values apply to the black layer only.
- <sup>(2)</sup>Dispersion applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- $^{(3)}$ Roll lengths and widths have a tolerance of  $\pm$  1%.
- •GSE White Smooth is available in rolls weighing approximately 4,000 lb.
- •All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D1204 and LTB of <-77° C when tested according to ASTM D 746.
- \*Modified.

TABLE 1.4: GSE LEAK LOCATION SMOOTH GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimu	n Average	· Values		
			40 mil	60 mil	80 mil	100 mil	
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90	
Density, g/cm <sup>3</sup> , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	
Tensile Properties (each direction) Strength at Break, lb/inwidth Strength at Yield, lb/inwidth Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	152 84 700 12	228 126 700 12	304 168 700 12	380 210 700 12	
Tear Resistance, lb	ASTM D 1004	45,000 lbs	28	42	56	70	
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	72	108	144	180	
Carbon Black Content <sup>(1)</sup> , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100	
Typical Roll Dimensions							
Roll Length <sup>(3)</sup> , ft			870	560	430	340	
Roll Width <sup>(3)</sup> , ft			22.5	22.5	22.5	22.5	



Roll Area, ft <sup>2</sup>	19,575	12,600	9,675	7,650
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#### • NOTES:

- •(1)GSE Leak Location Smooth may have an overall ash content of 3.0% due to the conductive layer. These values apply to the non-conductive black layer only.
- <sup>(2)</sup>Dispersion applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (3) Roll lengths and widths have a tolerance of  $\pm$  1%.
- •GSE Leak Location Smooth is available in rolls weighing approximately 4,000 lb.
- •All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D746.
- \*Modified.



TABLE 1.5: GSE LEAK LOCATION WHITE SMOOTH GEOMEMBRANE							
Tested Property	Test Method	Frequency	1	m Average	e Values		
		1 - 1 /	40 mil	60 mil	80 mil	100 mil	
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90	
Density, g/cm³, (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	
Tensile Properties (each direction) Strength at Break, lb/inwidth Strength at Yield, lb/inwidth Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	152 84 700 12	228 126 700 12	304 168 700 12	380 210 700 12	
Tear Resistance, lb	ASTM D 1004	45,000 lbs	28	42	56	70	
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	72	108	144	180	
Carbon Black Content <sup>(1)</sup> , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	
Notch Constant Tensile Load, hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100	
Typical Roll Dimensions							
Roll Length <sup>(3)</sup> , ft			870	560	430	340	
Roll Width <sup>(3)</sup> , ft			22.5	22.5	22.5	22.5	
Roll Area, ft <sup>2</sup>			19,575	12,600	9,675	7,650	

- (1) GSE Leak Location White Smooth may have an overall ash content of 3.0% due to the white and conductive layers. These values apply to the black layer only.
- <sup>(2)</sup>Dispersion applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (3) Roll lengths and widths have a tolerance of  $\pm$  1%.
- •GSE Leak Location White Smooth is available in rolls weighing approximately 4,000 lb.
- •All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.
- \*Modified.



TABLE 1.6: GSE ULTRAFLEX SMOOTH GEOMEMBRANE								
Tested Property	Test Method	Frequency	Minimu	m Average	e Value			
1 /		7	40 mil	60 mil	80 mil	100 mil		
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90		
Density, g/cm³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939		
Tensile Properties (each direction) Strength at Break, lb/inwidth Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	152 800	228 800	304 800	380 800		
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55		
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	56	84	112	140		
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0		
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(1)</sup>	Note <sup>(1)</sup>	Note <sup>(1)</sup>	Note <sup>(1)</sup>		
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100		
Typical Roll Dimensions								
Roll Length <sup>(2)</sup> , ft			870	560	430	340		
Roll Width <sup>(2)</sup> , ft			22.5	22.5	22.5	22.5		
Roll Area, ft <sup>2</sup>			19,575	12,600	9,675	7,650		

- (1)Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (2) Roll lengths and widths have a tolerance of  $\pm 1$  %.
- •GSE UltraFlex is available in rolls weighing approximately 4,000 lb.
- •All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
- \*Modified.



TALBE 1.7: GSE ULTRAFLEX WHITE SMOOTH GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimur	n Average	· Value		
			40 mil	60 mil	80 mil	100 mil	
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90	
Density, g/cm³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939	
Tensile Properties (each direction) Strength at Break, lb/inwidth Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	152 800	228 800	304 800	380 800	
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55	
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	56	84	112	140	
Carbon Black Content <sup>(1)</sup> , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100	
Typical Roll Dimensions							
Roll Length <sup>(3)</sup> , ft			870	560	430	340	
Roll Width <sup>(3)</sup> , ft			22.5	22.5	22.5	22.5	
Roll Area, ft <sup>2</sup>			19,575	12,600	9,675	7,650	

- (1) GSE UltraFlex White Smooth may have an overall ash content greater than 3.0% due to the white layer. These values apply to the black layer only.
- (2) Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (3) Roll lengths and widths have a tolerance of  $\pm 1\%$ .
- •GSE UltraFlex White Smooth is available in rolls weighing approximately 4,000 lb.
- All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
- \*Modified.



TABLE 1.8: GSE ULTRAFLEX LEAK LOCATION LINER SMOOTH GEOMEMBRANE								
Tested Property	Test Method	Frequency	Minimum Average Value					
			40 mil	60 mil	80 mil	100 mil		
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90		
Density, g/cm³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939		
Tensile Properties (each direction) Strength at Break, lb/inwidth Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	152 800	228 800	304 800	380 800		
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55		
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	56	84	112	140		
Carbon Black Content <sup>(1)</sup> , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0		
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>		
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100		
Typical Roll Dimensions								
Roll Length <sup>(3)</sup> , ft			870	560	430	340		
Roll Width <sup>(3)</sup> , ft			22.5	22.5	22.5	22.5		
Roll Area, ft <sup>2</sup>			19,575	12,600	9,675	7,650		

- (1) GSE UltraFlex Leak Location Smooth may have an overall ash content greater than 3.0% due to the conductive layer. These values apply to the non-conductive black layer only.
- (2) Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (3) Roll lengths and widths have a tolerance of  $\pm 1\%$ .
- •GSE UltraFlex Leak Location Smooth is available in rolls weighing approximately 4,000 lb.
- All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
- \*Modified.



TABLE 1.9: GSE ULTRAFLE	TABLE 1.9: GSE ULTRAFLEX LEAK LOCATION LINER WHITE SMOOTH GEOMEMBRANE							
Tested Property	Test Method	Frequency	Minimur	n Average	Value			
			40 mil	60 mil	80 mil	100 mil		
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90		
Density, g/cm³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939		
Tensile Properties (each direction) Strength at Break, lb/inwidth Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	152 800	228 800	304 800	380 800		
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55		
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	56	84	112	140		
Carbon Black Content <sup>(1)</sup> , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0		
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>		
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100		
Typical Roll Dimensions								
Roll Length <sup>(3)</sup> , ft			870	560	430	340		
Roll Width <sup>(3)</sup> , ft			22.5	22.5	22.5	22.5		
Roll Area, ft <sup>2</sup>			19,575	12,600	9,675	7,650		

- (1) GSE UltraFlex Leak Location White Smooth may have an overall ash content greater than 3.0% due to the white and conductive layers. These values apply to the non-conductive black layer only.
- (2) Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (3) Roll lengths and widths have a tolerance of  $\pm 1\%$ .
- •GSE UltraFlex Leak Location White Smooth is available in rolls weighing approximately 4,000 lb.
- •All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
- \*Modified.



- E. Textured surfaced geomembrane shall meet the requirements shown in the following data sheets below.
  - 1. Table 2.1 for Black coextruded textured HDPE
  - 2. Table 2.2 for Green coextruded textured HDPE
  - 3. Table 2.3 for White coextruded textured HDPE
    - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
    - b. The white surface shall be installed upwards.
  - 4. Table 2.4 for Leak Location Liner coextruded textured HDPE
    - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
    - b. The white surface shall be installed upwards.
  - 5. Table 2.5 for White Leak Location Liner coextruded textured HDPE
    - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
    - b. The white surface shall be installed upwards.
  - 6. Table 2.6 for Black coextruded textured LLDPE
  - 7. Table 2.7 for White coextruded textured LLDPE
    - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
    - b. The white surface shall be installed upwards.
  - 8. Table 2.8 for Leak Location Liner coextruded textured LLDPE
    - a. The geomembrane shall have a coextruded, electrically conductive layer.
    - b. The conductive layer is installed downward.
    - c. Electrical testing shall be performed after liner installation by the INSTALLER.
  - 9. Table 2.9 for White Leak Location Liner coextruded textured LLDPE
    - a. The geomembrane shall be a white-surfaced, coextruded geomembrane.
    - b. The white surface shall be installed upwards.
    - c. The geomembrane shall have a coextruded, electrically conductive layer.
    - d. The conductive layer is installed downward.
    - e. Electrical testing shall be performed after liner installation by the INSTALLER.



TABLE 2.1: GSE HD TEXTURED GEOMEMBRANE								
Tested Property Test Method Frequency			Minimum Average Values					
1 /		1 /	30 mil	40 mil	60 mil	80 mil	100 mil	
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	30 27	40 36	60 54	80 72	100 90	
Density, g/cm <sup>3</sup> , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940	
Tensile Properties (each direction) Strength at Break, lb/inwidth Strength at Yield, lb/inwidth Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	45 63 100 12	60 84 100 12	90 126 100 12	120 168 100 12	150 210 100 12	
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70	
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	45	60	90	120	150	
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(1)</sup>	Note <sup>(1)</sup>	Note <sup>(1)</sup>	Note <sup>(1)</sup>	Note <sup>(1)</sup>	
Asperity Height, mil	ASTM D 7466	second roll	16	18	18	18	18	
Notch Constant Tensile Load <sup>(2)</sup> , hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300	
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100	>100	
Typical Roll Dimensions								
Roll Length <sup>(3)</sup> , ft	Double-Sided Single-Sided Texture	Textured ed	830 1,010	700 780	520 540	400 410	330 330	
Roll Width <sup>(3)</sup> , ft			22.5	22.5	22.5	22.5	22.5	
Roll Area, ft <sup>2</sup>	Double-Sided Single-Sided Texture	Textured ed	18,675 22,725	15,750 17,550	11,700 12,150	9,000 9,225	7,425 7,425	



- (1) Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (2) NCTL for GSE HD Textured is conducted on representative smooth geomembrane samples.
- (3) Roll lengths and widths have a tolerance of  $\pm$  1%.
- •GSE HD Textured is available in rolls weighing approximately 4,000 lb.
- •All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D1204 and LTB of <-77° C when tested according to ASTM D 746.
- \*Modified.

TABLE 2.2 GSE GREEN TEXTURED GEOMEMBRANE									
Tested Property	Test Method	Frequency	Minimum Average Values						
			30 mil	40 mil	60 mil	80 mil	100 mil		
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	30 27	40 36	60 54	80 72	100 90		
Density, g/cm³, (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940		
Tensile Properties (each direction) Strength at Break, lb/inwidth Strength at Yield, lb/inwidth Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	45 63 100 12	60 84 100 12	90 126 100 12	120 168 100 12	150 210 100 12		
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70		
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	45	60	90	120	150		
Carbon Black Content <sup>(1)</sup> , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0		
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>		
Asperity Height, mil	ASTM D 7466	second roll	16	18	18	18	18		
Notch Constant Tensile Load <sup>(3)</sup> , hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300		
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100	>100		
Typical Roll Dimensions									
Roll Length <sup>(4)</sup> , ft	Double-Sided Single-Sided Textur	Textured red	830 1,010	700 780	520 540	400 410	330 330		
Roll Width <sup>(4)</sup> , ft			22.5	22.5	22.5	22.5	22.5		
			•	•					



Dall Arras 62	Double-Sided	Textured	18,675	15,750	11,700	9,000	7,425
Roll Area, ft <sup>2</sup>	Single-Sided Textured		22,725	1 <i>7,</i> 550	12,150	9,225	7,425

- •(1)GSE Green may have an overall ash content greater than 3.0% due to the green layer. These values apply to the black layer only.
- <sup>(2)</sup>Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (3) NCTL for GSE Green Textured is conducted on representative smooth geomembrane samples.
- <sup>(4)</sup>Roll lengths and widths have a tolerance of  $\pm 1\%$ .
- •GSE Green Textured is available in rolls weighing approximately 4,000 lb.
- •All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.
- \*Modified.



TABLE 2.3: GSE WHITE TEXTURED GEOMEMBRANE								
Tested Property Test Method Frequency				Minimum Average Values				
			30 mil	40 mil	60 mil	80 mil	100 mil	
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	30 27	40 36	60 54	80 72	100 90	
Density, g/cm3 , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940	0.940	
Tensile Properties (each direction) Strength at Break, lb/inwidth Strength at Yield, lb/inwidth Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	45 63 100 12	60 84 100 12	90 126 100 12	120 168 100 12	150 210 100 12	
Tear Resistance, lb	ASTM D 1004	45,000 lbs	21	28	42	56	70	
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	45	60	90	120	150	
Carbon Black Content <sup>(1)</sup> , %	ASTM D	20,000	2.0 -	2.0 -	2.0 -	2.0 -	2.0 -	
(Range)	1603*/4218	lbs	3.0	3.0	3.0	3.0	3.0	
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	
Asperity Height, mil	ASTM D 7466	second roll	16	18	18	18	18	
Notch Constant Tensile Load <sup>(3)</sup> , hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300	300	
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100	>100	
Typical Roll Dimensions								
Roll Length <sup>(4)</sup> , ft	Double-Sided Single-Sided Textur	Textured red	830 1,010	700 780	520 540	400 410	330 330	
Roll Width <sup>(4)</sup> , ft			22.5	22.5	22.5	22.5	22.5	
Roll Area, ft <sup>2</sup>	Double-Sided Single-Sided Textur	Textured red	18,675 22,725	15,750 17,550	11,700 12,150	9,000 9,225	7,425 7,425	



#### • NOTES:

- •(1)GSE White may have an overall ash content greater than 3.0% due to the white layer. These values apply to the black layer only.
- <sup>(2)</sup>Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (3) NCTL for GSE White Textured is conducted on representative smooth geomembrane samples.
- (4) Roll lengths and widths have a tolerance of  $\pm 1\%$ .
- •GSE White Textured is available in rolls weighing approximately 4,000 lb.
- •All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.
- \*Modified.



TABLE 2.4: GSE LEAK LOCATION LINER TEXTURED GEOMEMBRANE								
Tested Property	Test Method	Minimum Average Values						
1 /		, ,	40 mil	60 mil	80 mil	100 mil		
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	40 36	60 54	80 72	100 90		
Density, g/cm³, (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940		
Tensile Properties (each direction) Strength at Break, lb/inwidth Strength at Yield, lb/inwidth Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lbs	60 84 100 12	90 126 100 12	120 168 100 12	150 210 100 12		
Tear Resistance, lb	ASTM D 1004	45,000 lbs	28	42	56	70		
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	60	90	120	150		
Carbon Black Content <sup>(1)</sup> , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0		
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>		
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18		
Notch Constant Tensile Load <sup>(3)</sup> , hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300		
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100		
Typical Roll Dimensions								
Roll Length <sup>(4)</sup> , ft	Double-Sided Single-Sided Texture	Textured ed	700 780	520 540	400 410	330 330		
Roll Width <sup>(4)</sup> , ft			22.5	22.5	22.5	22.5		
Roll Area, ft <sup>2</sup>	Double-Sided Single-Sided Texture	Textured ed	15,750 17,550	11,700 12,150	9,000 9,225	7,425 7,425		



- (1) GSE Leak Location may have an overall ash content greater than 3.0% due to the conductive layer. These values apply to the non-conductive layer only.
- <sup>(2)</sup>Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (3) NCTL for GSE Leak Location Textured is conducted on representative smooth geomembrane samples.
- (4) Roll lengths and widths have a tolerance of  $\pm 1\%$ .
- •GSE Leak Location Textured is available in rolls weighing approximately 4,000 lb.
- •All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.
- \*Modified.



TABLE 2.5: GSE LEAK LOCA	TION LINER WHITE T	TEXTURED C	GEOMEM	BRANE		
Tested Property	Test Method	Frequency   Minimum Avera			num Average Values	
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	40 36	60 54	80 72	100 90
Density, g/cm3 , (min.)	ASTM D 1505	200,000 lbs	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-widtl Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %			60 84 100 12	90 126 100 12	120 168 100 12	150 210 100 12
Геаг Resistance, lb	ASTM D 1004	45,000 lbs	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	60	90	120	150
Carbon Black Content <sup>(1)</sup> , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Notch Constant Tensile Load <sup>(2)</sup> , hr	ASTM D 5397, Appendix	200,000 lbs	300	300	300	300
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length <sup>(4)</sup> , ft	Double-Sided Single-Sided Textured	Textured d	700 780	520 540	400 410	330 330
Roll Width <sup>(4)</sup> , ft			22.5	22.5	22.5	22.5
Roll Area, ft²	Double-Sided Single-Sided Textured	Textured d		1	9,000 9,225	7,425 7,425



#### • NOTES:

- •(1)GSE Leak Location White may have an overall ash content greater than 3.0% due to the conductive and white layers. These values apply to the non-conductive black layer only.
- (2) Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (3) NCTL for GSE Leak Location White Textured is conducted on representative smooth geomembrane samples.
- (4) Roll lengths and widths have a tolerance of  $\pm 1\%$ .
- •GSE Leak Location White Textured is available in rolls weighing approximately 4,000 lb.
- •All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77° C when tested according to ASTM D 746.
- \*Modified.

TABLE 2.6: GSE ULTRAFLEX TEXTURED GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimu	n Average	e Values	
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/inwidth Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	60 250	90 250	120 250	150 250
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	44	66	88	110
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(1)</sup>	Note <sup>(1)</sup>	Note <sup>(1)</sup>	Note <sup>(1)</sup>
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length <sup>(2)</sup> , ft	Double-Sided Textured Single-Sided Textured		700 650	520 420	400 320	330 250
Roll Width <sup>(2)</sup> , ft			22.5	22.5	22.5	22.5
Roll Area, ft <sup>2</sup>	Double-Sided Single-Sided Texture	Textured ed	15,750 14,625	11,700 9,450	9,000 7,200	7,425 5,625



- (1) Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (2) Roll lengths and widths have a tolerance of  $\pm 1\%$ .
- •GSE UltraFlex Textured is available in rolls weighing approximately 4,000 lb.
- •All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
- \*Modified.



TABLE 2.7: GSE ULTRAFLEX WHITE TEXTURED GEOMEMBRANE						
Tested Property	Test Method	Frequency	Minimur	n Average	· Values	
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/inwidth Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	60 250	90 250	120 250	150 250
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	44	66	88	110
Carbon Black Content <sup>(1)</sup> , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length <sup>(3)</sup> , ft	Double-Sided Textured Single-Sided Textured		700 650	520 420	400 320	330 250
Roll Width <sup>(3)</sup> , ft			22.5	22.5	22.5	22.5
Roll Area, ft <sup>2</sup>	Double-Sided Single-Sided Texture	Textured ed	15,750 14,625	11,700 9,450	9,000 7,200	7,425 5,625

- (1) GSE UltraFlex White Textured may have an overall ash content greater than 3.0% due to the white layer. These values apply to the black layer only.
- <sup>(2)</sup>Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (3) Roll lengths and widths have a tolerance of  $\pm 1\%$ .
- •GSE UltraFlex White Textured is available in rolls weighing approximately 4,000 lb.
- •All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
- \*Modified.



TABLE 2.8: GSE ULTRAFLEX LEAK LOCATION TEXTURED GEOMEMBRANE						
Tested Property	Test Method	Frequency		m Average	e Values	
1 /		1 /	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/inwidth Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	60 250	90 250	120 250	150 250
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	44	66	88	110
Carbon Black Content <sup>(1)</sup> , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length <sup>(3)</sup> , ft	Double-Sided Textured Single-Sided Textured		700 650	520 420	400 320	330 250
Roll Width <sup>(3)</sup> , ft			22.5	22.5	22.5	22.5
Roll Area, ft <sup>2</sup>	Double-Sided Single-Sided Texture	Double-Sided Textured		11,700 9,450	9,000 7,200	7,425 5,625

- •(1)GSE UltraFlex Leak Location Textured may have an overall ash content greater than 3.0% due to the conductive layer. These values apply to the non-conductive black layer only.
- (2) Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (3) Roll lengths and widths have a tolerance of  $\pm 1\%$ .
- •GSE UltraFlex Leak Location Textured is available in rolls weighing approximately 4,000 lb.
- •All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
- \*Modified.



TABLE 2.9: GSE ULTRAFLEX LEAK LOCATION WHITE TEXTURED GEOMEMBRANE						
Tested Property	Test Method	Frequency		m Average		
		1 /	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm³ (max.)	ASTM D 1505	200,000 lbs	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/inwidth Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lbs	60 250	90 250	120 250	150 250
Tear Resistance, lb	ASTM D 1004	45,000 lbs	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lbs	44	66	88	110
Carbon Black Content <sup>(1)</sup> , % (Range)	ASTM D 1603*/4218	20,000 lbs	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lbs	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>	Note <sup>(2)</sup>
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Oxidative Induction Time, min	ASTM D 3895, 200°C; O <sub>2</sub> , 1 atm	200,000 lbs	>100	>100	>100	>100
Typical Roll Dimensions						
Roll Length <sup>(3)</sup> , ft	Double-Sided Single-Sided Texture	Textured ed	700 650	520 420	400 320	330 250
Roll Width <sup>(3)</sup> , ft			22.5	22.5	22.5	22.5
Roll Area, ft <sup>2</sup>	Double-Sided Single-Sided Texture	Textured ed	15,750 14,625	11,700 9,450	9,000 7,200	7,425 5,625

- •(1)GSE UltraFlex Leak Location White Textured may have an overall ash content greater than 3.0% due to the white and conductive layers. These values apply to the non-conductive black layer only.
- <sup>(2)</sup>Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (3) Roll lengths and widths have a tolerance of  $\pm 1\%$ .
- •GSE UltraFlex Leak Location White Textured is available in rolls weighing approximately 4,000 lb.
- •All GSE geomembranes have dimensional stability of  $\pm 2\%$  when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
- \*Modified.



- F. Extrudate Rod or Bead
  - 1. Extrudate material shall be made from same type resin as the geomembrane.
  - 2. Additives shall be thoroughly dispersed.
  - 3. Materials shall be free of contamination by moisture or foreign matter.

## 1.9 EQUIPMENT

- A. Welding equipment and accessories shall meet the following requirements:
  - 1. Gauges showing temperatures in apparatus such as extrusion welder or fusion welder shall be present.
  - 2. An adequate number of welding apparatus shall be available to avoid delaying work.
  - 3. Power source must be capable of providing constant voltage under combined line load.

#### 1.10 DEPLOYMENT

- A. Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site.
- B. Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.
- C. Deployment of geomembrane panels shall be performed in a manner that will comply with the following guidelines:
  - 1. Geomembranes shall be installed according to site-specific specifications, and GSE Conductive should be installed with the Conductive layer down.
    - i. Note: A spark tester or ohm meter can be used to determine Conductive layer.
  - 2. Unroll geomembrane using methods that will not damage geomembrane and will protect underlying surface from damage (spreader bar, protected equipment bucket).
  - 3. Place ballast (commonly sandbags) on geomembrane which will not damage geomembrane to prevent wind uplift.
  - 4. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage it. Smoking will not be permitted on the geomembrane.
  - 5. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than 8 psi.
  - 6. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.
- D. Sufficient material (slack) shall be provided to allow for thermal expansion and contraction of the material.

#### 1.11 FIELD SEAMING

A. Seams shall meet the following requirements:



- 1. To the maximum extent possible, orient seams parallel to the line of the slope, i.e., down and not across slope.
- 2. Minimize number of field seams in corners, odd-shaped geometric locations and outside corners.
- 3. Slope seams (panels) shall extend a minimum of 5-ft beyond the grade break into the flat area.
- 4. Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the CONSULTANT and INSTALLER.
- 5. Align seam overlaps consistent with the requirements of the welding equipment being used. A 6-in overlap is commonly suggested.

## B. During Welding Operations

 Provide at least one Master Seamer who shall provide direct supervision over other welders as necessary.

#### C. Extrusion Welding

- 1. Hot-air tack adjacent pieces together using procedures that do not damage the geomembrane.
- 2. Clean geomembrane surfaces by disc grinder or equivalent.
- 3. Purge welding apparatus of heat-degraded extrudate before welding.

#### D. Hot Wedge Welding

- 1. Welding apparatus shall be a self-propelled device equipped with an electronic controller which displays applicable temperatures.
- 2. Clean seam area of dust, mud, moisture and debris immediately ahead of hot wedge welder.
- 3. Protect against moisture build-up between sheets.

#### E. Trial Welds

- 1. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.
- 2. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.
- 3. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.
- 4. Cut four, one-inch wide by six-inch long test strips from the trial weld.
- 5. Quantitatively test specimens for peel adhesion, and then for shear strength.
- 6. Trial weld specimens shall pass when the results shown in the following tables for HDPE and LLDPE are achieved in both peel and shear test.



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TABLE 1.12.6A: MINIMUM WELD VALUES FOR HDPE GEOMEMBRANES							
Property	Test Method	30	40	60	80	100	120
Peel Strength (fusion), ppi Peel Strength (extrusion), ppi	ASTM D 6392 ASTM D 6392	49 39	65 52	98 78	130 104	162 130	196 157
Shear Strength (fusion & ext.), ppi	ASTM D 6392	61	81	121	162	203	242

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TABLE 1.2.6B: MINIMUM WELD VALUES FOR LLDPE GEOMEMBRANES							
Property	Test Method		30	40	60	80	100
Peel Strength (extrusion), ppi Peel Strength (fusion), ppi	ASTM 6392 ASTM 6392	D D	36 38	48 50	72 75	96 100	120 125
Shear Strength (fusion & ext.), ppi	ASTM 6392	D	45	60	90	120	150

- 7. The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB).
- 8. The break is ductile.
- 9. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.
- 10. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.
- F. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. INSTALLER shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.
- G. Defects and Repairs
  - 1. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.
  - 2. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.



## 1.12 FIELD QUALITY ASSURANCE

- A. MANUFACTURER and INSTALLER shall participate in and conform to all terms and requirements of the Owner's quality assurance program. CONTRACTOR shall be responsible for assuring this participation.
- B. Quality assurance requirements are as specified in this Section and in the Field Installation Quality Assurance Manual if it is included in the contract.
- C. Field Testing
  - 1. Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming.
    - b. Vacuum Testing
      - 1) Shall be performed in accordance with ASTM D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
    - b. Air Pressure Testing
      - 1) Shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.
    - c. Spark Testing
      - Shall be performed accordance with ASTM D 7240 Standard Practice for Leak Location using Geomembranes with an Insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive Geomembrane Spark Test).
    - d. Other approved methods.
  - 2. Destructive Testing (performed by CONSULTANT with assistance from INSTALLER)
    - b. Location and Frequency of Testing
      - 1) Collect destructive test samples at a frequency of one per every 500 lineal feet of seam length.
      - 2) Test locations will be determined after seaming.
      - 3) Exercise Method of Attributes as described by GRI GM-14 (Geosynthetic Research Institute, <a href="http://www.geosynthetic-institute.org">http://www.geosynthetic-institute.org</a>) to minimize test samples taken.
    - c. Sampling Procedures are performed as follows:
      - 1) INSTALLER shall cut samples at locations designated by the CONSULTANT as the seaming progresses in order to obtain field laboratory test results before the geomembrane is covered.
      - 2) CONSULTANT will number each sample, and the location will be noted on the installation as-built.
        - a) Samples shall be 12-in wide by minimal length with the seam centered lengthwise.
        - b) Cut a 2-in wide strip from each end of the sample for field-testing.
        - c) Cut the remaining sample into two parts for distribution as follows:
        - d) One portion for INSTALLER, 12-in by 12-in



- e) One portion for the Third-Party laboratory, 12-in by 18-in
- f) Additional samples may be archived if required.
- Destructive testing shall be performed in accordance with ASTM D 6392, Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
  - a) INSTALLER shall repair all holes in the geomembrane resulting from destructive sampling.
- 4) Repair and test the continuity of the repair in accordance with these Specifications.
- 3. Failed Seam Procedures
  - a. If the seam fails, INSTALLER shall follow one of two options:
    - 1) Reconstruct the seam between any two passed test locations.
    - 2) Trace the weld to intermediate location at least 10-ft minimum or where the seam ends in both directions from the location of the failed test.
    - b) The next seam welded using the same welding device is required to obtain an additional sample, i.e., if one side of the seam is less than 10ft long.
    - c) If sample passes, then the seam shall be reconstructed or capped between the test sample locations.
    - d) If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

#### 1.13 REPAIR PROCEDURES

- A. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.
- B. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.
- C. INSTALLER shall be responsible for repair of defective areas.
- D. Agreement upon the appropriate repair method shall be decided between
  - 1. CONSULTANT and INSTALLER by using one of the following repair methods:
    - a. Patching- Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
    - b. Abrading and Re-welding- Used to repair short section of a seam.
    - Spot Welding- Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
    - d. Capping- Used to repair long lengths of failed seams.
    - e. Flap Welding- Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.
      - 1) Remove the unacceptable seam and replace with new material.
- E. The following procedures shall be observed when a repair method is used:
  - 1. All geomembrane surfaces shall be clean and dry at the time of repair.
  - 2. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.



- 3. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.
- F. Repair Verification
  - 1. Number and log each patch repair (performed by CONSULTANT).
  - 2. Non-destructively test each repair using methods specified in this Specification.



#### 1.1 SCOPE

This specification covers the technical requirements for the Manufacturing and Installation of the nonwoven geotextile. All materials meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these project specifications.

#### 1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
- 1. ASTM D 5261, Standard Test Method for Measuring Mass per Unit Area of Geotextiles
- 2. ASTM D 4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
- 3. ASTM D 4533, Standard Test Method for Index Trapezoidal Tearing Strength of Geotextiles
- 4. ASTM D 4833, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
- 5. ASTM D 4491, Standard Test Method for Water Permeability of Geotextiles by Permittivity
- 6. ASTM D 4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile
- 7. ASTM D 4354, Standard Practice for Sampling of Geosynthetics for Testing
- 8. ASTM D 4759, Standard Practice for Determining the Specifications Conformance of Geosynthetics

#### 1.3 SUBMITTALS

- A. Prior to material delivery to project site, the contractor shall provide the engineer with a written certification or manufacturers quality control data which displays that the geotextile meets or exceeds minimum average roll values (MARV) specified herein.
- B. The contractor shall submit, if required by the engineer, manufacturer's quality control manual for the geotextile to be delivered to the site.

#### 2. PRODUCT

#### 2.1 GEOTEXTILE

- A. The nonwoven needle-punched geotextile specified herein shall be made from staple fiber.
- B. The geotextile shall be manufactured from prime quality virgin polymer.
- C. The geotextile shall be able to withstand direct exposure to ultraviolet radiation from Sun for up to 30 days without any noticeable effect on index or performance properties.
- D. Geotextile shall meet or exceed all material properties listed in *Table 1*.





TABLE 1: GEOTEXTILE PROPERTIES						
Property	Test Method	Test Frequency	Value			
Mass per Unit Area, oz/yd²	ASTM D 5261	90,000-ft <sup>2</sup>	12			
Grab Tensile Strength, lb	ASTM D 4632	90,000-ft <sup>2</sup>	320			
CBR Puncture Strength, lb	ASTM D 6241	540,000-ft <sup>2</sup>	925			
Grab Elongation, %	ASTM D 4632	90,000-ft²	50			
Trapezoidal Tear Strength, lb	ASTM D 4533	90,000-ft²	125			
UV Resistance, % retained after 500 hours	ASTM D 4355	per formulation	70			

#### 2.2 MANUFACTURE

A. All rolls of the geotextile shall be identified with permanent marking on the roll or packaging, with the manufacturers name, product identification, roll number, and roll dimensions.

#### 2.3 TRANSPORT

- A. Transportation of the geotextile shall be the responsibility of the contractor.
- B. During shipment, the geotextile shall be protected from ultraviolet light exposure, precipitation, mud, dirt, dust, puncture, or other damaging or deleterious conditions.
- C. Upon delivery at the job site, the contractor shall ensure that the geotextile rolls are handled and stored in accordance with the manufacturer's instructions as to prevent damage.

#### 3. EXECUTION

#### 3.1 QUALITY ASSURANCE

A. The engineer shall examine the geotextile rolls upon delivery to the site and report any deviations from project specifications to the contractor.

#### 3.2 INSTALLATION



- A. The geotextile shall be handled in such a manner as to ensure that it is not damaged in any way. Should the contractor damage the geotextile to the extent that it is no longer usable as determined by these specifications or by the engineer, the contractor shall replace the geotextile at his own cost.
- B. The geotextile shall be installed to the lines and grades as shown on the contract drawings and as described herein.
- C. The geotextile shall be rolled down the slope in such a manner as to continuously keep the geotextile in tension by self-weight. The geotextile shall be securely anchored in an anchor trench where applicable, or by other approved or specified methods.
- D. In the presence of wind, all geotextiles shall be weighted by sandbags or approved equivalent. Such anchors shall be installed during placement and shall remain in place until replaced with cover material.
- E. The contractor shall take necessary precautions to prevent damage to adjacent or underlying materials during placement of the geotextile. Should damage to such material occur due to the fault of the contractor, the latter shall repair the damaged materials at his own cost and to the satisfaction of the engineer.
- F. During placement of the geotextile, care shall be taken not to entrap soil, stones or excessive moisture that could hamper subsequent seaming of the geotextile as judged by the engineer.
- G. The geotextile shall not be exposed to precipitation prior to being installed and shall not be exposed to direct sunlight for more than 15 days after installation.
- H. The geotextile shall be seamed using heat seaming or stitching methods as recommended by the manufacturer and approved by the engineer. Sewn seams shall be made using polymeric thread with chemical resistance equal to or exceeding that of the geotextile. All sewn seams shall be continuous. Seams shall be oriented down slopes perpendicular to grading contours unless otherwise specified. For heat-seaming, fusion welding techniques recommended by the manufacturer shall be used.
- I. The contractor shall not use heavy equipment to traffic above the geotextile without approved protection.
- J. The geotextile shall be covered as soon as possible after installation and approval. Installed geotextile shall not be left exposed for more than 15 days.
- K. Material overlying the geotextile shall be carefully placed to avoid wrinkling or damage to the geotextile.



#### SINGLE SIDED GEOCOMPOSITE

#### 1.1 SCOPE

This specification covers the technical requirements for the manufacturing and installation of the geocomposite drainage layer. All materials meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these project specifications.

#### **REFERENCES** 1.2

- A. American Society for Testing and Materials (ASTM)
  - 1. ASTM D 1238 Standard Test Method for Melt Flow Rates of Thermoplastics
  - 2. by Extrusion Plastometer
  - 3. D 1505-98 Standard Test Method for Density of Plastics by the Density-Gradient Technique
  - 4. ASTM D 4218, Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle Furnace Technique D 1603-94 Standard Test Method for Carbon Black in Olefin Plastics
  - 5. D 4355-02 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
  - 6. D 4491-99 Standard Test Method for Water Permeability of Geotextiles by Permittivity
  - 7. D4533 Standard Test Method for Trapezoid Tearing Strength of Geotextiles
  - 8. D 4716-00 Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
  - 9. D 4751-99 Standard Test Method for Determining Apparent Opening Size of a Geotextile
  - 10. D 6241 Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile- Related Products Using a 50-mm Probe D 4833-88 (1996) Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and **Related Products**
  - 11. D 5261-92 (1996) Standard Test Method for Measuring the Mass Per Unit Area of Geotextiles
  - 12. D7005-03 Determining The Bond Strength (Ply-Adhesion) of Geocomposites
  - 13. D 7179 Standard Test Method for Determining Geonet Breaking Force
- B. Relevant publications from the Environmental Protection Agency (EPA):
  - 1. Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.



#### 1.3 **DEFINITIONS**

- A. Construction Quality Assurance Consultant (CONSULTANT) The Party, independent from MANUFACTURER and INSTALLER, that is responsible for observing and documenting activities related to quality assurance during the lining system construction.
- B. ENGINEER The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.
- C. Geocomposite Manufacturer (MANUFACTURER) The party responsible for manufacturing the geocomposite rolls.
- D. Geosynthetic Quality Assurance Laboratory (TESTING LABORATORY) -The Party, independent from the MANUFACTURER and INSTALLER, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing, usually under the direction of the OWNER.
- E. INSTALLER- Party responsible for field handling, transporting, storing and deploying the geocomposite.
- F. Lot- A quantity of resin (usually the capacity of one rail car) used to manufacture polyethylene geocomposite rolls. The finished rolls will be identified by a roll number traceable to the resin lot.

## 1.4 QUALIFICATIONS

#### A. MANUFACTURER

- 1. Geocomposite shall be manufactured by the following:
- a. GSE Lining Technology, Inc.
- b. Approved Equal
- 2. MANUFACTURER shall have manufactured a minimum of 10,000,000-ft<sup>2</sup> of polyethylene geocomposite material during the last year.

#### B. INSTALLER

- 1. INSTALLER shall have installed a minimum of 500,000 square feet of geocomposite in the last 3 years.
- 2. INSTALLER shall have worked in a similar capacity on at least 5 projects similar in complexity to the project described in the contract documents, and within at least 50,000 square feet of geonet installation on each project.
- 3. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.

#### 1.5 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

- A. Labeling- Each roll delivered to the site shall be wrapped and labeled by the MANUFACTURER. The label will identify:
  - 1. Manufacturer's name
  - 2. Product identification
  - 3. Length
  - 4. Width
  - 5. Roll number





- C. Delivery- Rolls will be prepared to ship by appropriate means to prevent damage to the material and to facilitate off-loading.
- D. Storage- The on-site storage location provided by the CONTRACTOR to protect the geonet from abrasions, excessive dirt and moisture, shall have the following characteristics:
  - 1. Level (no wooden pallets)
  - 2. Smooth
  - 3. Dry
  - 4. Protected from theft and vandalism
  - 5. Adjacent to the area being lined

#### E. Handling

- 1. The CONTRACTOR and INSTALLER shall handle all rolls in such a manner to ensure they are not damaged in any way.
- 2. The INSTALLER shall take any necessary precautions to prevent damage to underlying layers during placement of the drainage material.

#### 1.6 WARRANTY

- A. Material shall be warranted, on a pro-rata basis against defects for a period of 1-year from the date of the geocomposite installation.
- B. Installation shall be warranted against defects in workmanship for a period of 1-year from the date of geocomposite completion.

#### 2. PRODUCTS

#### 2.1 GEOCOMPOSITE PROPERTIES

- A. A geocomposite shall be manufactured by extruding two crossing strands to form a biplanar drainage net structure with a non-woven geotextile bonded to one or both—sides.
- B. The geocomposite specified shall have properties that meet or exceed the values listed in the following data sheets below.



TABLE 1: GEOCOMPOSITE PROPERTIES						
Property	Test Method	Frequency	Value			
Geocomposite						
Transmissivity (1), gal/min/ft (m2/sec) Single-Sided Composite	ASTM D 4716	1/540,000-ft <sup>2</sup>	6.2 (1.3 x 10-3)			
Ply Adhesion, lb/in	ASTM D 7005	1/50,000-ft <sup>2</sup>	0.5			
Geonet	T	T				
Geonet Core Thickness, mil (1)	ASTM D 5199	1/50,000-ft <sup>2</sup>	270			
Transmissivity (2), gal/min/ft (m2/sec)	ASTM D 4716	1/540,000-ft <sup>2</sup>	19 (4 x 10-3)			
Compressive Strength, lbs/ft	ASTM D 6364	1/540,000-ft <sup>2</sup>	40,000			
Density, g/cm3	ASTM D 1505	1/50,000-ft <sup>2</sup>	0.94			
Tensile Strength (MD), lb/in	ASTM D 7179	1/50,000-ft <sup>2</sup>	100			
Carbon Black Content, %	ASTM D 4218	1/50,000-ft <sup>2</sup>	2.0			
8 oz. Geotextile (prior to lamination)	<u></u>					
Mass per Unit Area, oz/yd2	ASTM D 5261	1/90,000-ft <sup>2</sup>	8			
Grab Tensile Strength, lb	ASTM D 4632	1/90,000-ft <sup>2</sup>	220			
Grab Elongation	ASTM D 4632	1/90,000-ft <sup>2</sup>	50%			
CBR Puncture Strength, lb	ASTM D 6241	1/540,000-ft <sup>2</sup>	575			
Trapezoidal Tear Strength, lb	ASTM D 4533	1/90,000-ft <sup>2</sup>	90			
AOS, US Sieve (mm)	ASTM D 4751	1/540,000-ft <sup>2</sup>	80 (0.180)			
Permittivity, sec-1	ASTM D 4491	1/540,000-ft <sup>2</sup>	1.3			
Water Flow Rate, gpm/ft2	ASTM D 4491	1/540,000-ft <sup>2</sup>	95			
UV Resistance, % Retained	ASTM D 4355 (after 500 hours)	per formulation	70			

• Note: The design engineer shall prepare the table above based on the GSE product data sheet and then delete this note



#### C. Resin

- 1. Resin shall be new first quality, compounded polyethylene resin.
- 2. Natural resin (without carbon black) shall meet the following additional
- minimum requirements:

TABLE 2: RAW MATERIAL PROPERTIES					
Property	Test Method <sup>(1)</sup>	Value			
Density (g/cm³)	ASTM D 1505	>0.94			
Melt Flow Index (g/10 min)	ASTM D 1238	<u>&lt; 1.0</u>			

<sup>1</sup>GSE utilizes test equipment and procedures that enable effective and economical confirmation that the product will conform to specifications based on the noted procedures. Some test procedures have been modified for application to geosynthetics. All procedures and values are subject to change without prior notification.

#### 2.2 MANUFACTURING QUALITY CONTROL

The geocomposite shall be manufactured in accordance with the Manufacturer's Quality Control Plan submitted to and approved by the ENGINEER.

The geocomposite shall be tested according to the test methods and frequencies listed on Table 1 which has been prepared based on product data sheets.

#### 3. **EXECUTION**

#### 3.1 **FAMILIARIZATION**

#### A. Inspection

- 1. Prior to implementing any of the work in the Section to be lined, the INSTALLER shall carefully inspect the installed work of all other Sections and verify that all Work is complete to the point where the installation of the Section may properly commence without adverse impact.
- If the INSTALLER has any concerns regarding the installed work of other Sections, he shall notify the Project ENGINEER.

#### 3.2 **MATERIAL PLACEMENT**

- A. The geocomposite roll should be installed in the direction of the slope and in the intended direction of flow unless otherwise specified by the ENGINEER.
  - 1. If the project contains long, steep slopes, special care should be taken so that only full length rolls are used at the top of the slope.



- B. In the presence of wind, all geocomposites shall be weighted down with sandbags or the equivalent. Such sandbags shall be used during placement and remain until replaced with cover material.
- C. If the project includes an anchor trench at the top of the slopes, the geocomposite shall be properly anchored to resist sliding. Anchor trench compacting equipment shall not come into direct contact with the geocomposite.
- D. In applying fill material, no equipment can drive directly across the geocomposite. The specified fill material shall be placed and spread utilizing vehicles with a low ground pressure.
- E. The cover soil shall be placed in the geocomposite in a manner that prevents damage to the geocomposite. Placement of the cover soil shall proceed immediately following the placement and inspection of the geocomposite.

#### 3.3 SEAMS AND OVERLAPS

- A. Each component of the geocomposite will be secured or seamed to the like component at overlaps.
- B. Geonet Components
  - 1. Adjacent edges of the geonet along the length of the geocomposite roll shall be placed with the edges of each geonet butted against each other.
  - 2. The overlaps shall be joined by tying the geonet structure with cable ties. These ties shall be spaced every 5-ft along the roll length.
  - Adjoining geocomposite rolls (end to end) across the roll width should be shingled down in the direction of the slope, with the geonet portion of the top overlapping the geonet portion of the bottom geocomposite a minimum of 12-in across the roll width.
  - 4. The geonet portion should be tied every 6-in in the anchor trench or as specified by the ENGINEER.

#### 3.4 REPAIR

- A. Prior to covering the deployed geocomposite, each roll shall be inspected for damage resulting from construction.
- B. Any rips, tears or damaged areas on the deployed geocomposite shall be removed and patched. The patch shall be secured to the original geonet by tying every 6-in with the approved tying devices. If the area to be repaired is more than 50 percent of the width of the panel, the damaged area shall be cut out and the two portions of the geonet shall be cut out and the two portions of the geonet shall be joined in accordance with *Subsection* 3.03.



**C147L REGISTRATION PACKAGE ANGELL RECYCLE FACILITY** SECTION 8, TOWNSHIP 17 SOUTH, RANGE 33 EAST LEA COUNTY, NEW MEXICO 023249-00

# **APPENDIX F**

# **OPERATING AND MAINTENANCE PLAN**

F



Spur Energy is proposing to construct four (4) storage pits in Section 8, Township 17 South, Range 33 East, Lea County, New Mexico. Bish Recycle shall consist of four (4) containments with a total operational volume of approximately 1,446,337-bbl. The facility will have one containment that holds a capacity of 151,903-bbl and three containments that hold a capacity of 431,478-bbl each.

#### OPERATION AND MAINTENANCE PROCEDURES

In this plan, <u>underlined text</u> represents the language of the Rule.

The operator will operate and maintain the lined earthen containments to contain liquids and solids (blow sand and minimal precipitates from the treated produced water) and maintain the integrity of the liner system in a manner that prevents contamination of fresh water and protects public health and the environment as described below. The purpose of the lined earthen containments is to facilitate recycling, reuse, and reclamation of produced water derived from nearby oil and gas wells. During periods when water for E&P operations is not needed, produced water will discharge to one of the injection wells in the operator's SWD system. The containment will not be used for the disposal of produced water or other oilfield waste.

The operation of the Recycling Containment is summarized below:

- 1. Via pipeline, produced water generated from nearby oil and gas wells is delivered to a treatment system located as indicated in the C-147.
- 2. After treatment, the produced water discharges into the containment.
- 3. When required, treated produced water is removed from the containment for E&P operations. At this time, treated produced water will be used for drilling beneath the fresh water zones (beneath surface casing), for well stimulation (e.g. hydraulic fracturing) and other E&P uses as approved by OCD.
- 4. Whenever the maximum fluid capacity of the containment is reached, treatment and discharge to the containment ceases (see Freeboard and Overtopping Plan, below).
- 5. The operator will keep accurate records and shall report monthly to the division the total volume of water received for recycling, with the amount of fresh water received listed separately, and the total volume of water leaving the facility for disposition by use on form C-148.
- 6. The operator will maintain accurate records that identify the sources and disposition of all recycled water that shall be made available for review by the division upon request.
- 7. The containment shall be deemed to have ceased operations if less than 20 % of the total fluid capacity is used every six months following the first withdrawal of produced water for use. The operator will report cessation of operations to the appropriate division district office. The appropriate division district office may grant an extension to this determination of cessation of operations not to exceed six months.

The operation of the lined earthen containment will follow the mandates listed below:

- 1. The operator will not discharge into or store any hazardous waste (as defined by 40 CFR 261 and NMAC 19.15.2.7.H.3) in the containments.
- 2. If the containment's primary liner is compromised above the fluid's surface, the operator will repair the damage or initiate replacement of the primary liner within 48 hours of discovery or seek an extension of time from the Division District office.



- 3. <u>If the primary liner is compromised below the fluid's surface, the operator will remove all fluid above the damage or leak within 48 hours of discover, notify the division district office, and repair the damage or replace the primary liner.</u>
- 4. If any penetration of the containment liner is confirmed by sampling of fluid in the leak detection system (see Inspection and Monitoring Plan), the operator will:
  - a. Begin and maintain fluid removal from the leak detection/pump-back system,
  - b. Notify the District office within 48 hours (phone or email) of the discovery,
  - c. Identify the location of the leak, and
  - d. Repair the damage or, if necessary, replace the containment liner.
- 5. The operator will install, or maintain onsite, an oil absorbent boom or other device to contain an unanticipated release and the operator will remove any visible layer of oil from the surface of the recycling containment.
- 6. The operator will report releases of fluid in a manner consistent with NMAC 19.15.29.
- 7. The containment will be operated to prevent the collection of surface water run-on.
- 8. The operator will maintain the containment free of miscellaneous solid waste or debris.
- 9. The operator will maintain at least 3-ft of freeboard for the containment and will use a welded ladder gauge to allow easy determination of the required 3-ft of freeboard.
- 10. As described in the design/construction plan, the injection or withdrawal of fluids from the containment is accomplished through hardware that prevents damage to the liner by erosion, fluid jets, or impact from installation and removal of hoses or pipes.
- 11. The operator shall ensure that all gates associated with the fence are closed and locked when responsible personnel are not onsite.
- 12. The operator will maintain the fences in good repair.

## MONITORING, INSPECTION, AND REPORTING PLAN

The operator will inspect the recycling containment and associated leak detection systems weekly while it contains fluids. The operator shall maintain a current log of such inspections and make the log available for review by the division upon request.

Weekly inspections consist of:

- 1. Reading and recording the fluid height of staff gauges,
- 2. Recording any evidence that the pond surface shows visible oil,
- 3. Visually inspecting the containment's exposed liners, and
- 4. Checking the leak detection system for any evidence of a loss of integrity of the primary liner.

As stated above, if a liner's integrity is compromised, or if any penetration of the liner occurs above the water surface, then the operator will notify the District office within 48 hours (phone or email).

Monthly, the operator will:

- 1. Inspect diversion ditches and berms around the containment to check for erosion and collection of surface water run-on.
- 2. Inspect the leak detection system for evidence of damage or malfunction and monitor for leakage.
- 3. Inspect the containment for migratory birds and other wildlife. 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.
- 4. Report to the division the total volume of water received for recycling, with the amount of fresh water received listed separately, and the total volume of water leaving the facility for disposition by use on form C-148.
- 5. Record sources and disposition of all recycled water.

The operator will maintain a log of all inspections and make the log available for the appropriate Division District office's review upon request.

#### FREEBOARD AND OVERTOPPING PREVENTION PLAN

The method of operation of the containment allows for maintaining freeboard with very few potential problems. When the capacity of the containment is reached (3-ft of freeboard), the discharge of treated produced water ceases and the produced water generated by nearby oil and gas wells is managed by disposing of fluid at a local injection well.

If rising water levels suggest that 3-ft of freeboard will not be maintained, the operator will implement one or more of the following options:

- 1. Cease discharging treated produced water to the containment.
- 2. Accelerate re-use of the treated produced water for purposes approved by the Division.
- 3. Transfer treated produced water from the containment to a Division approved injection well.

The reading of the staff gauge typically occurs daily when treatment operations are ongoing and weekly when discharge to the containment is not occurring.

# PROTOCOL FOR LEAK DETECTION MONITORING, FLUID REMOVAL, AND REPORTING

As shown in *Appendix D*, the leak detection system includes a monitoring system. Any fluid released from the primary liner will flow to the collection sump, where fluid level monitoring is possible at the monitoring riser pipe associated with the leak detection system.

Staff may employ a portable electronic water level meter to determine if fluid exists in the monitoring riser pipe. Obtaining accurate readings of water levels in a sloped pipe beneath a containment can be a challenge. An electrician's wire snake may be required to push the probe to the bottom of the port and the probe may be fixed in a 2-in pipe "dry housing" to avoid false readings due to water condensation on the pipe. There are many techniques to determine the existence of water in the sumps, including low-flow pumps and a simple small bailer affixed to an electrician's snake. The operator will use the method that works best for this containment.

If seepage from the containment into the leak detection system is suspected by a positive fluid level measurement, the operator will:

- 1. Re-measure fluid levels in the monitoring riser pipe on a daily basis for one week to determine the rate of seepage.
- 2. Collect a water sample from the monitoring riser pipe to confirm the seepage is treated produced water from the containment via field conductivity and chloride measurements.



- 3. Notify NMOCD of a confirmed positive detection in the system within 48 hours of sampling (initial notification).
- 4. Install a pump into the monitoring riser pipe sump to continually (manually on a daily basis or via automatic timers) remove fluids from the leak detection system into the containment until the liner is repaired or replaced.
- 5. Dispatch a liner professional to inspect the portion of the containment suspected of leakage during a "low water" monitoring event.
- 6. Provide NMOCD a second report describing the inspection and/or repair within 20 days of the initial notification.

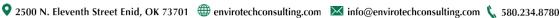
If the point of release is obvious from a low water inspection, the liner professional will repair the loss of integrity. If the point of release cannot be determined by the inspection, the liner professional will develop a more robust plan to identify the point(s) of release. The inspection plan and schedule will be submitted to OCD with the second report. The operator will implement the plan upon OCD approval.



**C147L REGISTRATION PACKAGE ANGELL RECYCLE FACILITY** SECTION 8, TOWNSHIP 17 SOUTH, RANGE 33 EAST LEA COUNTY, NEW MEXICO 023249-00

# **APPENDIX G**

**CLOSURE PLAN** 





G



CLOSURE PLAN
SPUR ENERGY PARTNERS
ANGELL RECYCLE
LEA COUNTY, NEW MEXICO
023249-00

Spur Energy is proposing to construct four (4) storage pits in Section 8, Township 17 South, Range 33 East, Lea County, New Mexico. Bish Recycle shall consist of four (4) containments with a total operational volume of approximately 1,446,337-bbl. The facility will have one containment that holds a capacity of 151,903-bbl and three containments that hold a capacity of 431,478-bbl each.

#### **CLOSURE PLAN**

In this plan, <u>underlined text</u> represents the language of the Rule.

After operations cease, the operator will remove all fluids within 60 days and close the containment within six months from the date the operator ceases operations from the containment for use.

The operator shall substantially restore the impacted surface area to

- 1. The condition that existed prior to the construction of the recycling containment or
- 2. To a condition <u>imposed by federal, state trust land, or tribal agencies on lands managed by those agencies as these provisions govern the obligations of any operator subject to those provisions.</u>

#### EXCAVATION AND REMOVAL CLOURE PLAN - PROTOCOLS AND PROCEDURES

The storage pits are expected to ain a small volume of solids, the majority of which will be windblown sand and dust with so eral precipitates from the water.

The operator will remove all lipits and either:

- a. Dispose or the liquids in a division-approved facility, or
- b. Recycle, reuse, or reclaim the water for reuse in drilling and stimulation

The operator will close the recycling containment by first removing all fluids, contents, and synthetic liners and transferring these materials to a Division approved facility.

After the removal of the pit contents and liners, soils beneath the workover pit will be tested by collection of <u>a five-point (minimum) composite sample</u>, which includes stained or wet soils, if any. That sample shall be analyzed for the constituents listed in *Table 1* of 19.15.34.14.

After review of the laboratory results:

- a. <u>If any contaminant concentration is higher than the parameters listed in *Table 1*, additional delineation may be required, and the operator must receive approval before proceeding with closure.</u>
- b. <u>If all contaminant concentrations are less than or equal to the parameters listed in *Table* 1, then the operator will proceed to:</u>
  - i. Backfill with non-waste containing, uncontaminated earthen material or
  - ii. Undertake an alternative closure process pursuant to a variance request after approval by OCD.

The operator will reclaim the containment's location to a safe and stable condition that blends with the surrounding undisturbed area.

<u>Topsoils and subsoils shall be replaced to their original relative positions and contoured so as to achieve</u> erosion control, long-term stability, and preservation of surface water flow patterns.



CLOSURE PLAN
SPUR ENERGY PARTNERS
ANGELL RECYCLE
LEA COUNTY, NEW MEXICO
023249-00

The disturbed area shall then be reseeded in the first favorable growing season following closure of a recycling containment.

#### **CLOSURE DOCUMENTATION**

Within 60 days of closure completion, the operator shall submit a closure report on Form C-147, including required attachments, to document all closure activities including sampling results and the details on any backfilling, capping or covering, where applicable. The closure report shall certify that all information in the report and attachments is correct and that the operator has complied with all applicable closure requirements and conditions specified in division rules or directives.

The operator shall notify the division when reclamation and re-vegetation are complete. Specifically, the notice will document that 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 plus 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.



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# Spur Energy Partners Angell Recycle Facility Closure Cost Estimate

	ltem	Units	Quanity	\$/Unit	Estimate Cost
	Facility Closure				•
1	Fluid removal				
	Angell North Storage Pit (152K bbls)	bbls	151,903	\$ 0.75	\$ 113,927.25
	Angell South Storage Pits (431K bbls each)	bbls	1,294,434	\$ 0.75	\$ 970,825.50
2	Vac truck (final fluid removal)	hrs	24	\$ 125.00	\$ 3,000.00
3	Liner removal (fold-in-place)				
	Covers removal and disposal	SF	5,851,814	\$ 0.18	\$ 1,053,326.52
4	Equipment removal				
	Pit clean-out and residue haul-off	LS	1	\$ 10,000.00	\$ 10,000.00
	Equipment removal (tanks, gun barrel, FWKO)	LS	1	\$ 7,500.00	\$ 7,500.00
	Electrical decomissioning (pumps and panels)	LS	1	\$ 5,000.00	\$ 5,000.00
	Misc equipment clean-up and removal	hr	160	\$ 135.00	\$ 21,600.00
5	Site Restoration				
	Dozer - push in berms (bid) and final grading of the site	CY	161,380	\$ 5.00	\$ 806,900.00
	Re-vegetation	ea	1	\$ 5,500.00	\$ 5,500.00

#### **Estimated Total**

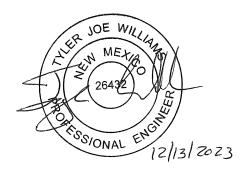
\$ 2,997,579.27

#### **Assumptions**

No Remediation will be necessary

Pit is full at time of closure

Pit berms above natural grade will be used to fill voids below natural grade



## Venegas, Victoria, EMNRD

From: Venegas, Victoria, EMNRD

Sent: Wednesday, January 3, 2024 2:36 PM

**To:** Sarah Chapman; twilliams@envirotechconsulting.com **Subject:** 1RF-514 - ANGELL RECYCLE FACILITY [fVV2400347551]

Attachments: C-147 1RF-514 - ANGELL RECYCLE FACILITY [fVV2400347551].pdf

#### 1RF-514 - ANGELL RECYCLE FACILITY [fVV2400347551]

Good afternoon Ms. Chapman,

NMOCD has reviewed the recycling containment permit application and related documents, submitted by [328947] Spur Energy Partners LLC on December 20, 2023, for 1RF-514 - ANGELL RECYCLE FACILITY [fVV2400347551] in Unit Letter I, Section 08, Township 17S, Range 33E, Lea County, New Mexico. [328947] Spur Energy Partners LLC requested variances from 19.15.34 NMAC for 1RF-514 - ANGELL RECYCLE FACILITY [fVV2400347551] related to 19.15.34. NMAC

The following variances have been approved:

- The variance from 19.15.34.13.E NMAC for the installation of an audible "Bird-X Mega Blaster Pro" bird deterrence system is approved.
- The variance to NMAC 19.15.34.12.D to install a wire mesh, game fence, eight (8) feet in height is approved.
- The variance to 19.15.34.12.A.(4) NMAC for the installation of a 40-mil non-reinforced LLDPE secondary liner is approved. The proposed liner system cross-section for the earthen containment is as follows: prepare subgrade, 10 oz. geotextile, 40-mil HDPE secondary liner, 200-mil geonet, 60-mil HDPE primary liner.

The form C-147 and related documents for the 1RF-514 - ANGELL RECYCLE FACILITY [fVV2400347551] is approved with the following conditions of conditions of approval:

- The purpose of this permit is for oil and gas activities regulated under the NMAC 19.15.34.3 STATUTORY AUTHORITY: 19.15.34 NMAC is adopted pursuant to the Oil and Gas Act, Paragraph (15) of Section 70-2-12(B) NMSA 1978, which authorizes the division to regulate the disposition of water produced or used in connection with the drilling for or producing of oil and gas or both and Paragraph (21) of Section 70-2-12(B) NMSA 1978 which authorizes the regulation of the disposition of nondomestic wastes from the exploration, development, production or storage of crude oil or natural gas.
- [328947] Spur Energy Partners LLC shall construct, operate, maintain, close, and reclaim the 1RF-514 ANGELL RECYCLE FACILITY [fVV2400347551] in compliance with 19.15.34 NMAC.
- 1RF-514 ANGELL RECYCLE FACILITY [fVV2400347551] is approved for five years of operation from the date of permit application. 1RF-514 ANGELL RECYCLE FACILITY [fVV2400347551] permit expires on December 20, 2028.
- The 1RF-514 ANGELL RECYCLE FACILITY [fVV2400347551] shall consist of four earthen containments:
  - Angell North Pit 151,000 bbl capacity, Angell West Pit with 431,000 bbl capacity, Angell Middle Pit with 431,000 bbl capacity and Angell East Pit with 431,000 bb capacity, all at 3 feet freeboard.
- The total fluid capacity of 1RF-514 ANGELL RECYCLING FACILITY [fVV2400347551] is 1,444,000.00 bbl.
- The total closure cost estimate for 1RF-514 ANGELL RECYCLE FACILITY [fVV2400347551] in the amount of \$ 2,997,579.27, meets the requirements of NMAC 19.15.34.15.A.(1). [328947] Spur Energy Partners LLC cannot receive produced water in the 1RF-514 - ANGELL RECYCLE FACILITY [fVV2400347551] until after the original copy of the financial assurance has been accepted by NMOCD.
- The financial assurance bond should be mailed to the Oil Conservation Division; Bonding and Compliance; 1220 South St Frances Drive; Santa Fe, NM 87505.
- [328947] Spur Energy Partners LLCLLC shall notify NMOCD when construction of the 1RF-514 ANGELL RECYCLE FACILITY [fVV2400347551] commences.

- [328947] Spur Energy Partners LLC shall notify NMOCD when recycling operations commence and cease at 1RF-514 ANGELL RECYCLE FACILITY [fVV2400347551].
- A minimum of 3-feet freeboard must be maintained 1RF-514 ANGELL RECYCLE FACILITY [fVV2400347551] recycling containment, at all times during operations.
- If less than 20% of the total fluid capacity is utilized every six months, beginning from the first withdrawal, operation of the facility is considered ceased and notification of cessation of operations should be sent electronically to <a href="OCD Online">OCD Online</a>. An extension to extend the cessation of operation, not to exceed six months, may be submitted using a C-147 form through <a href="OCD Online">OCD Online</a>.
- [328947] Spur Energy Partners LLCLLC shall submit monthly reports of recycling and reuse of produced water, drilling fluids, and liquid oil field waste on NMOCD form C-148 through OCD Online even if there is zero activity.
- [328947] Spur Energy Partners LLC shall comply with 19.15.29 NMAC Releases in the event of any release of produced water or other oil field wastes at 1RF-514 ANGELL RECYCLE FACILITY [fVV2400347551].
- According to Table 1 of 19.15.34.14, the closure criteria for 1RF-514 ANGELL RECYCLE FACILITY [fVV2400347551] is for groundwater depth of 51 to 100 feet.

Please reference number 1RF-514 - ANGELL RECYCLE FACILITY [fVV2400347551] in all future communications. Regards,

Victoria Venegas • Environmental Specialist

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EMNRD - Oil Conservation Division
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**State of New Mexico Energy, Minerals and Natural Resources Oil Conservation Division** 1220 S. St Francis Dr. **Santa Fe, NM 87505** 

CONDITIONS

Action 296707

#### **CONDITIONS**

Operator:	OGRID:
Spur Energy Partners LLC	328947
9655 Katy Freeway	Action Number:
Houston, TX 77024	296707
	Action Type:
	[C-147] Water Recycle Long (C-147L)

#### CONDITIONS

Created By	Condition	Condition Date
vvenegas	NMOCD has reviewed and approved the recycling containment permit application and related documents, submitted by [328947] Spur Energy Partners LLC on December 20, 2023, for 1RF-514 - ANGELL RECYCLE FACILITY [fVV2400347551] in Unit Letter I, Section 08, Township 17S, Range 33E, Lea County, New Mexico.	1/3/2024